MID WEST PORTS

Maintenance dredging

# 2022 FISHING BOAT HARBOUR ENTRANCE MAINTENANCE, DREDGE ENVIRONMENTAL MANAGEMENT PLAN

Prepared by O2 MARINE

## Purpose

The Dredge Environmental Management Plan (DEMP) is designed to manage the Fishing Boat Harbour (FBH) entrance dredge program to protect and maintain the ecological values of Champion Bay. MWPA has identified the potential environmental impacts via a detailed environmental impact assessment and the DEMP sets out environmental management targets and actions.

The DEMP describes how the dredge program will be undertaken and outlines the environmental protection objectives, management measures, and targets for the successful execution of the dredge program.

## Importance

The project's environmental performance will be monitored and validated through a detail management and monitoring program. The DEMP:

- Informs the dredging contractor's management plans and procedures;
- Defines the monitoring methods, frequency, sampling locations and triggers for action; and
- Defines MWPA stakeholder and performance reporting requirements.

## MONITOR & MANAGE

- ✓ **Marine fauna observers on board vessel**
- ✓ Daily plume monitoring
- ✓ **Hydrographic surveys**
- ✓ Regular monitoring of water quality
- ✓ **Pre and post dredge benthic habitat surveys**
- ✓ Consultation with stakeholders
- ✓ **100% reuse of dredged sediments**

## Outcomes

The Dredge Environmental Management Plan is designed to manage the dredge program to protect and maintain the ecological values of Champion Bay.

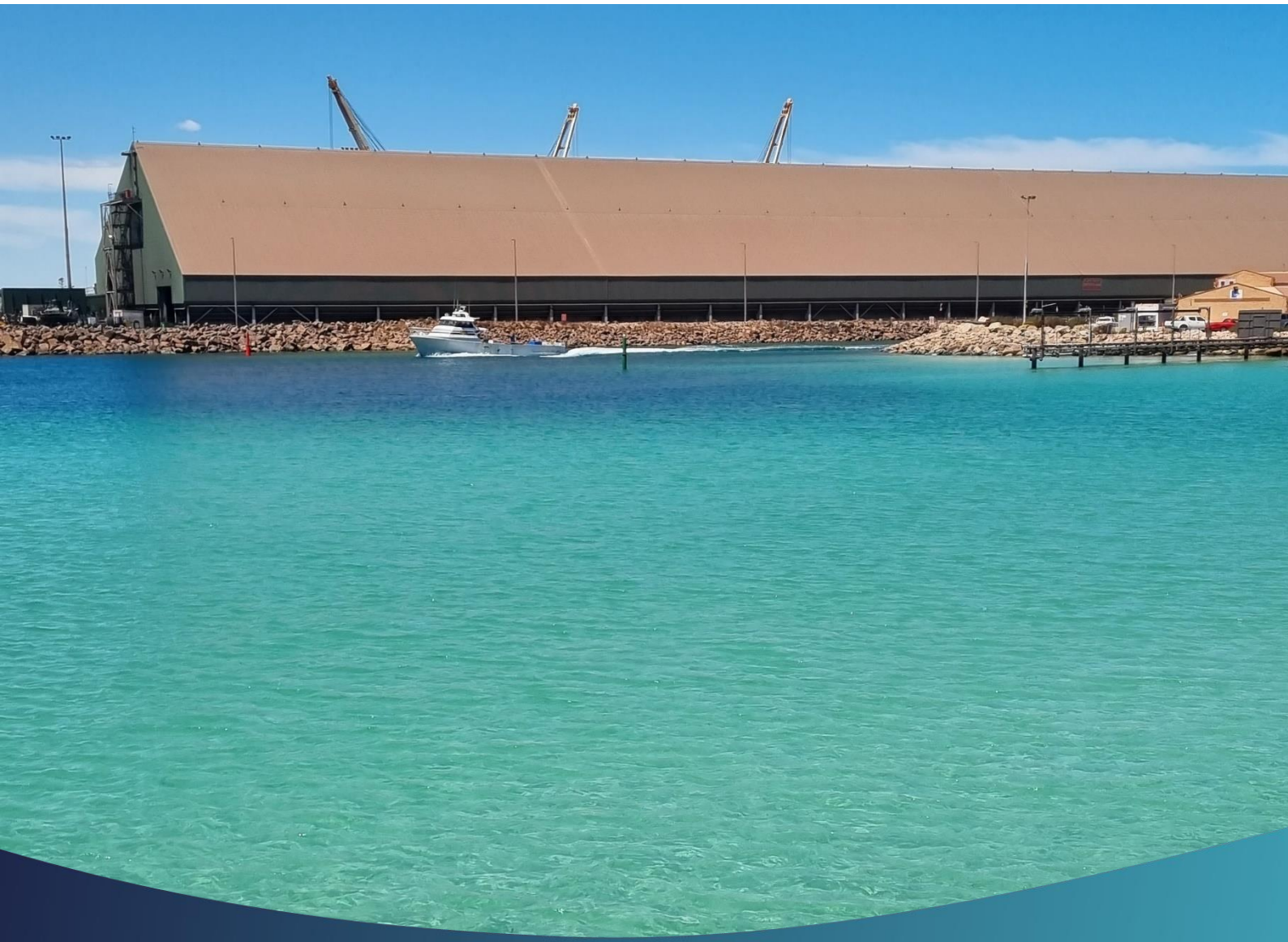
## Public Input

Input from a public two week consultation period held in August 2022, have been incorporated into this plan.

# Geraldton Fishing Boat Harbour Entrance Maintenance Dredge 2022

## Dredging Environmental Management Plan

ENVIRONMENT
An O2Marine company



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Acronyms and Abbreviations

| Acronyms/Abbreviation | Description |
|---|---|
| BCH | Benthic Communities And Habitat |
| CSD | Cutter Suction Dredge |
| DEMP | Dredge Management and Monitoring Plan |
| DMPA | Dredge Material Placement Area |
| DO | Dissolved Oxygen |
| DWER | Department of Water and Environmental Regulation |
| EIA | Environmental Impact Assessment |
| EPO | Environmental Protection Outcomes |
| FBH | Fishing Boat Harbour |
| GFC | Geraldton Fisherman's Cooperative |
| HEPA | High Ecological Protection Area |
| LEPA | Low Ecological Protection Area |
| MEPA | Moderate Ecological Protection Area |
| MFO | Marine Fauna Observer |
| MT | Management Target |
| MWPA | Mid West Ports Authority |
| MEQMP | Marine Environmental Quality Monitoring Program |
| NATA | National Association of Testing Authorities |
| SPL | Species Protection Levels |
| TEOM | Tapered Element Oscillating Microbalance |

# Contents

## Figures



## Tables

# 1. Introduction

## 1.1. Project Summary

The Mid West Ports Authority (MWPA) is proposing to undertake maintenance dredging of up to 40,000m$^3$ of accumulated sediments within the Fishing Boat Harbour (FBH) entrance and adjacent Lives Beach. Sediments are considered of natural origins and free from contamination and will be relocated to the existing Berth 7 land reclamation cell (herein referred to as the Berth 7 Dredge Material Placement Area (DMPA)).

## 1.2. Purpose of this Plan

The purpose of this Dredging Environmental Management Plan (DEMP) is to outline the Environmental Protection Outcomes (EPOs) and Management Targets (MTs) associated with the dredging and dredge material disposal to be undertaken for the maintenance dredging project. Detailed management and monitoring actions are included to ensure that the project EPOs are achieved.

## 1.3. Proponent Details

The proponent for the project is the Midwest Ports Authority (MWPA). Proponent details are provided in Table 1.

Table 1 Proponent Details

| | |
|---|---|
| Entity Name: | Mid West Ports Authority |
| Australian Business Number (ABN): | 73 384 989 178 |
| Address: | 298 Marine Terrace, Geraldton Western Australia 6530 |
| Key Contact (Role): | Damian Tully (CEO) |
| Key Contact Email: | communications@midwestports.com.au |

## 1.4. Legislation, Regulation and Guidelines

### 1.4.1. Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act* (1999) (EPBC Act) establishes a process for the assessment and approval of proposed actions that are likely to have a significant impact on matters of national environmental significance or on Commonwealth land.

### 1.4.2. Other Commonwealth Legislation, Regulation and Guidelines

Other applicable Commonwealth legislation and guidelines include, but are not limited to, the following Acts, Regulations (and relevant amendments):

- *Protection of the Seas (Prevention of Pollution from Ships) Act* 1983;
- Australian Ballast Water Management Requirements Version 7 2017;
- *Biosecurity Act* 2015;

- *Biosecurity Regulations* (2016); and
- National Water Quality Management Strategy (Commonwealth Government of Australia 1992).

### 1.4.3. State Legislation, Regulation and Guidelines

The key Western Australian legislation, regulation and guidelines relevant to dredging at the Port of Geraldton include:

- *Biodiversity Conservation Act* 2016;
- *Port Authorities Act* 1999;
- *Navigable Waters Regulations* 1958;
- *Shipping and Pilotage (Port and Harbour) Regulations* 1967
- *Western Australian Marine Act* 1982;
- *Pollution of Waters by Oil and Noxious Substances Act* 1987;
- *Marine and Harbours Act* 1981;
- *Environmental Protection Act* 1986;
- *Environmental Protection Regulations* 1987;
- *Fisheries Resource Management Act 1994* (the State Act addressing Introduced Marine Pests);
- Western Australia Environmental Protection Authority Technical Guidance - Assessment Guidelines of Marine Dredging Proposals (WA EPA, 2021a);
- Western Australia Environmental Protection Authority Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (WA EPA, 2016a); and
- Western Australia Environmental Protection Authority Technical Guidance – Protection of Benthic Communities and Habitats (WA EPA, 2016b).

## 1.5. Project Description

Table 2 Summary of the Project

| | |
|---|---|
| Project Title | Geraldton Fishing Boat Harbour 2022 Maintenance Dredging Project |
| Proponent Name | Midwest Ports Authority |
| Short Description | Conduct maintenance dredging of accumulated sediments within the FBH entrance and adjacent Lives Beach up to 40,000m$^3$. Sediments are considered of natural origins and free from contamination and will be relocated to the existing Berth 7 land reclamation cell. |

Table 3 Location and Proposed extent of operational elements

| Element | Location | Proposed Extent |
|---|---|---|
| Maintenance dredging of accumulated FBH entrance and Lives Beach sediments | Figure 1 | Removal of up to 40,000 $m^3$ of sediments from a proposed dredge footprint area of 26,690 $m^2$ via cutter suction dredge. |
| Land reclamation within existing Berth 7 DMPA | Figure 1 | Placement of up to 40,000 $m^3$ of dredge material into existing land reclamation cell north of Berth 7 |
| Seabed Levelling of the FBH entrance as a contingency measure | Figure 1 | Relocation of sediment from high points to low points in the immediate levelling area, does not involve disposal of sediments outside of the immediate project area. |


Figure 1 Proposed dredging and relocation footprints

# 2. Dredging Program

## 2.1. Schedule

The detailed schedule of works is yet to be confirmed, however it is confirmed that the dredging and material placement activities will be undertaken using a cutter suction dredge (CSD). Under the current project schedule, activities are planned to commence in mid-late August and be completed by mid-late September. Dredging and material placement is anticipated be completed within one month.

## 2.2. Proposed Operational Elements

### 2.2.1. Dredging Equipment

Dredging will be completed by a Cutter Suction Dredge (CSD) (Figure 2). These are typically non-propelled barges equipped with a hydraulic cutterhead, suction pipe and pumps.

During dredging, the cutterhead is lowered to the seabed, rotating and disturbing the material to be dredged. The cut material together with water is drawn into the suction mouth. This slurry mixture is then transported by the dredge pump through the discharge pipeline to the designated discharge site.

While operating, the CSD is considered stationary, with spud and anchor systems used for positioning the dredge within the dredging area. During the dredging works, a spud is lowered in the seabed to secure the vessel. Winches and anchors are used to swing the dredge from side to side allowing the cutterhead to removes material from the seabed.

The dredge is expected to be a small CSD with the following nominal specifications:

- Total Installed power: <200kW
- Length: ~25m
- Breadth: ~8m
- Draught: ~2m
- Discharge pipe diameter <400mm

It is expected that an operational efficiency of ~65% will be achieved, which allows for operational constrains such as weather and shipping. An average production rate is expected to be ~100-200$m^3$/hr.

Figure 2 Example CSD – CGC Dredging's Cooper II (Image source – CGC Dredging)

### 2.2.2. Dredging

Sediments up to ~40,000 m3 will be removed from within the FBH entrance channel and adjacent Lives Beach as presented in Figure 1. Dredged sediments will be transported to the Berth 7 DMPA via a pipeline directly from the CSD. Dredging will be conducted during 12-hour daily shift, with no night time operations conducted as part of this program. Sediments from within this dredge area are considered of natural origins and free from contamination (O2 Marine 2022e), adding to the self-neutralising and buffering capacity of sediments within reclamation area (Tetra Tech Coffey 2021) and therefore pose a very low risk for land-based relocation at the Berth 7 DMPA.

### 2.2.3. Berth 7 DMPA

In common with the 2002/2003 capital dredge, and the 2012 and 2021 maintenance dredge projects, dredged material will be relocated to the existing Berth 7 DMPA (Figure 1). The reclamation area was constructed during 2001 and 2002 as part of the MWPA's (formerly the Geraldton Port Authority) Port Enhancement Project. The reclamation area is double-lined with a layer of geotextile cloth and plastic membrane on the northern, eastern and western sides (Figure 3). The geotextile was used to ensure the containment of silts, while the plastic membrane was used to reduce the permeability of the bund wall (URS 2001a). The southern wall (i.e. harbour side) of the reclamation area was considered impermeable to sediments and was intentionally left unlined so that any water would preferentially flow back toward the harbour (i.e. away from open waters and the intakes of the lobster processing plants).

The location of the dredge discharge pipeline within the DMPA may be varied over the duration of the dredging to allow for the even placement of sediments within the area (Figure 4). Excess water ('tailwater') will return to the

northwest corner of the harbour via existing return water outlet pipes located in the south-western corner of the reclamation area (Figure 1 and Figure 4). A geotextile silt curtain will be installed within the reclamation area prior to the outlet pipes to minimise fine sediment release to the Harbour.

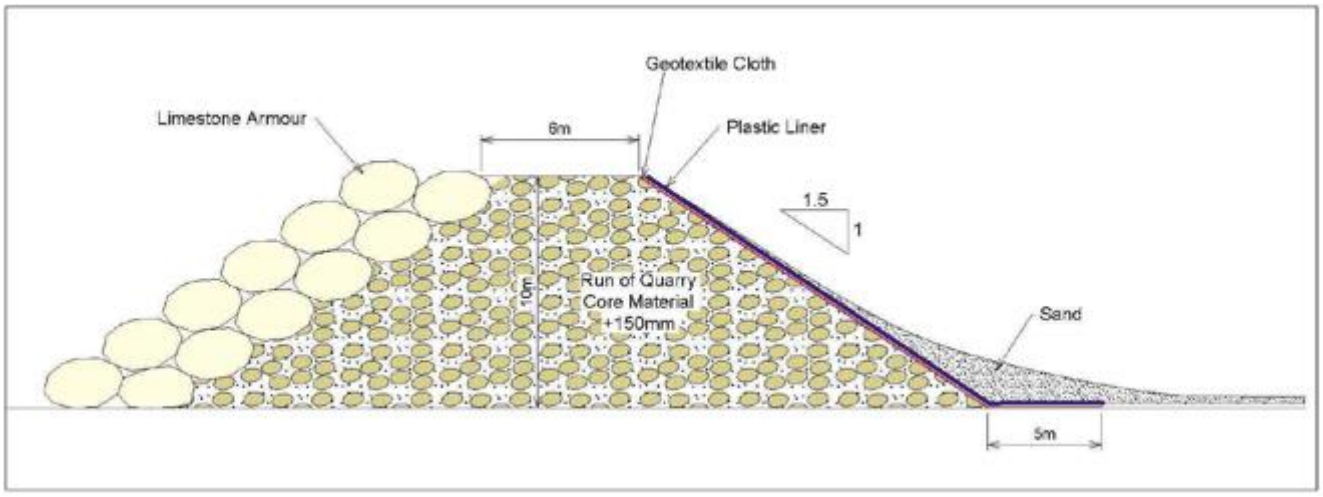


Figure 3 Bund wall cross section

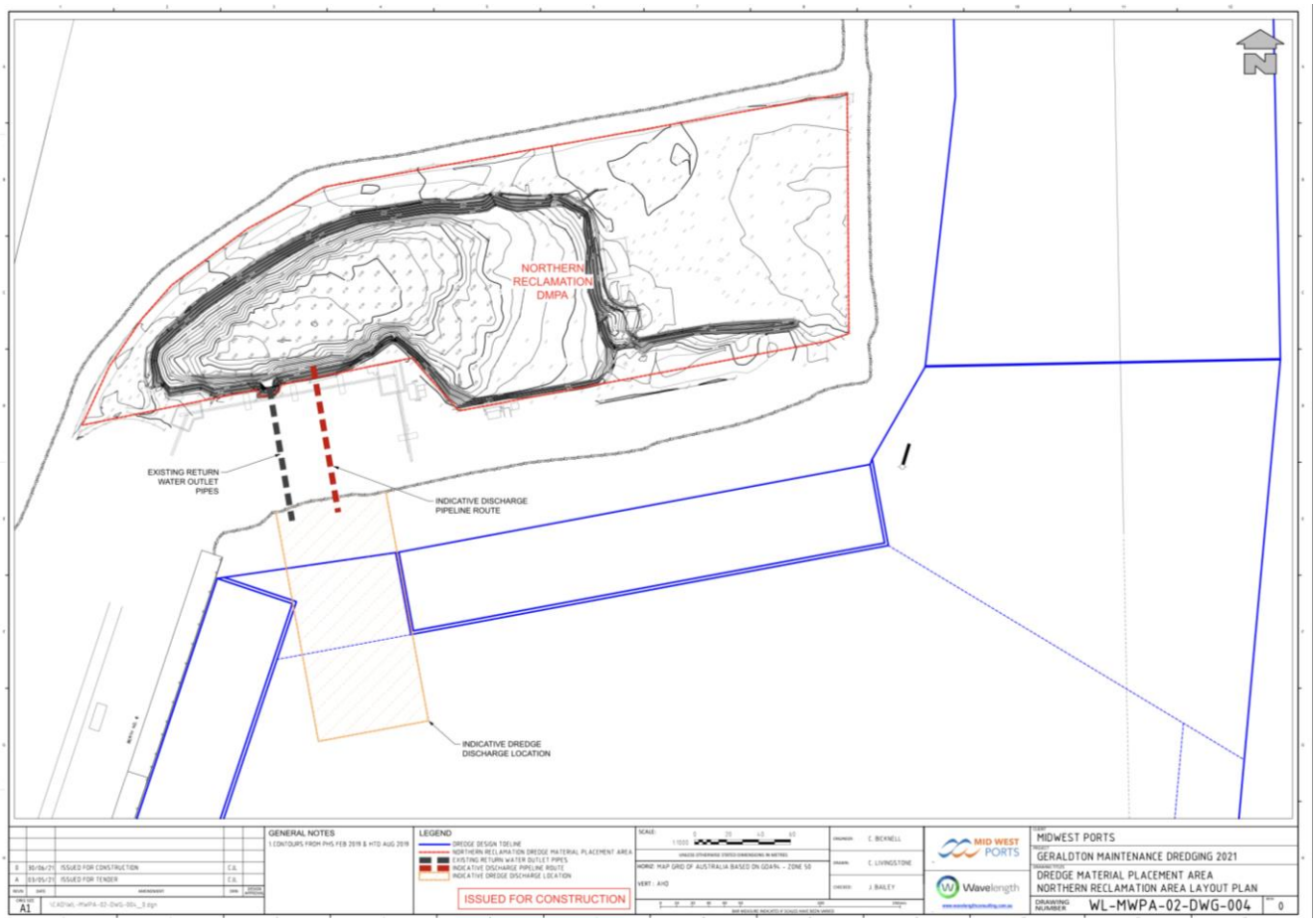


Figure 4 August 2019 survey of the existing Berth 7 DMPA

# 3. Roles and Responsibilities

The roles and responsibilities for the implementation of the DEMP are summarised in Table 4.

Table 4 Roles and responsibilities of key personnel

| Position | Responsibility |
|---|---|
| Proponent<br>(Mid West Ports Authority) | • Overall responsibility for implementation of this DEMP<br>• Overall responsibility for complying with relevant legislation, standards and guidelines<br>• Ensures dredging activities are conducted in an environment safe for both site personnel and the public<br>• Reports on environmental performance for the project to key stakeholders<br>• Responsible for environmental compliance reporting<br>• Responsible for reporting all environmental non-compliance incidents |
| Proponent's Representative<br>(Wavelength Consulting) | • Complies with the requirements of this DEMP<br>• Provides advice on dredging and dredge material environmental issues<br>• Oversee implementation of environmental controls, monitoring programs, inspections, audits and management actions in this DEMP<br>• Completes compliance reporting requirements<br>• Responsible for the implementation of the environmental monitoring program and inspections<br>• Prepares environmental monitoring reports<br>• Provides advice with respect to environmental issues as required |
| Dredging Contractor<br>(CGC Dredging) | • Undertakes dredging and placement works<br>• Prepares and implements an environmental management plan in accordance with the requirements of this DEMP<br>• Implements the management actions of this DEMP<br>• Ensures all staff are adequately trained for their area of responsibility<br>• Ensures all equipment is adequately maintained and correctly operated<br>• Responsible for reporting all environmental incidents to the Proponent within 24 hours in accordance with MWPA incident reporting procedures |
| All persons involved in the project | • Comply with the requirements of this DEMP<br>• Comply with all legal requirements under project approvals documents and or relevant Acts<br>• Exercise a Duty of Care to the environment at all times<br>• Report all environmental incidents |

# 4. Environmental Factors and Objectives

The key environmental factors and objectives to be managed under this DEMP have been derived from the Statement of Environmental Principles, Factors and Objectives (EPA 2021b), which outlines objectives aimed at protecting all environments (Themes) including: Sea, Land, Water, Air and People. The project specific Environmental Protection Outcomes (EPOs) and Management Targets (MTs) for each of the key environmental factors (benthic communities and habitats, marine environmental quality and air quality) and are outlined in Table 5.

Table 5 Key environmental factors and objectives, potential environmental impact pathways and management outcomes

| Environmental Factor | EPA Objective | Potential Environmental Impact Pathway | Environmental Protection Outcome | Management Target | Management Measures |
|---|---|---|---|---|---|
| Benthic Communities and Habitats (BCH) | To protect BCH so that biological diversity and ecological integrity are maintained. | Direct impacts to BCH due to removal within the dredge footprint. | No direct impacts or irreversible loss of BCH outside of the dredge footprint as spatially defined in Figure 1. | Dredging operations do not occur outside the dredge footprint as spatially defined in Figure 1. | Table 6 |
| | | Indirect impacts to BCH due to reduction in available light caused by increase in suspended sediments released into the water column during dredging. | No indirect or irreversible loss of BCH from baseline conditions outside the dredge footprint as spatially defined in Figure 1. | No detectable reduction in baseline condition of BCH outside of the dredge footprint as spatially defined in Figure 1. | |

| Environmental Factor | EPA Objective | Potential Environmental Impact Pathway | Environmental Protection Outcome | Management Target | Management Measures |
|---|---|---|---|---|---|
| **Marine Environmental Quality** | To maintain the quality of water, sediment and biota so that environmental values are protected. | Disturbance of existing contaminants in groundwater and soils within the Berth 7 DMPA sediments during sediment relocation and return water discharge has the potential to deteriorate water quality and contaminate marine organisms. | No residual impacts on marine environmental quality as a result of the dredging or tailwater return activities. | A 'Low Level of Ecological Protection' shall be maintained at point of dredge return water discharge as spatially defined in **Figure 5** and will return to a 'Moderate Level of Ecological Protection' within one month following cessation of discharge. | **Table 7** |
| | | Disturbance of existing nutrients in groundwater and soils within the Berth 7 DMPA sediments during sediment relocation and return water discharge has the potential to deteriorate water quality. | | | |
| | | Hydrocarbon release into the marine or terrestrial environment from a hydrocarbon spill and or bunkering operations. | | Manage refuelling, chemical storage and spill response to ensure no adverse impacts to the marine environment. | |
| **Air Quality** | To maintain air quality and minimise emissions so that environmental values are protected. | Earthworks associated with reclamation activities have the potential to create fugitive dust emissions from exposed batters or uncapped dredge material. | No increase from ambient dust concentrations as a result of terrestrial earthworks during the dredge project. | Particulates as PM10 remains below 50ug/$m^3$ averaged over 24hr, as recorded at the Connell Road real time dust monitor (TEOM). | **Table 8** |

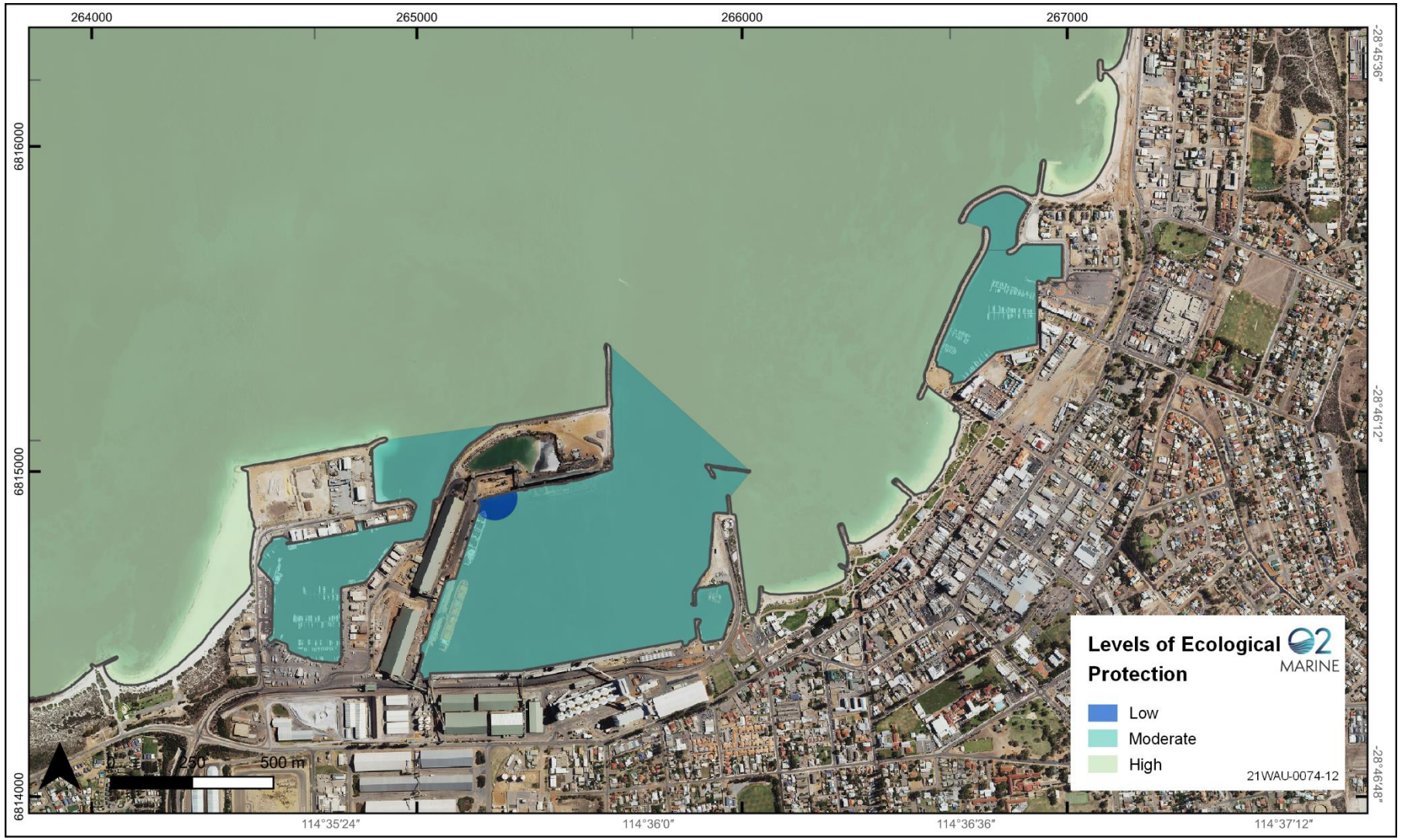


Figure 5 Proposed levels of ecological protection for the Port of Geraldton and surrounding waters.

# 5. Management

The potential environmental impacts (Table 5), have been assigned monitoring and management actions to ensure predicted impacts are commensurate with actual impacts and measure compliance against the EPOs[1] and MTs. Management actions have been separated into Tier 1 (which specifically address the three identified key environmental factors, benthic communities and habitat, marine environmental quality, and air quality); and Tier 2 (which relate to the overall works and can be managed through standard operational procedures, including introduced marine pests, hydrocarbons and waste).

A description of the existing environment is presented within Appendix A. This provides context for the environmental management and monitoring program detailed below with regards to the identified receptors that occur within the project area. This existing environment also formed the basis of the Project Environmental Impact Assessment (O2 Marine 2022a) which identified potential impacts which this plan aims to manage and monitor to ensure the EPOs and MTs are met during implementation of the Project.

[1] EPOs identified in Table 5 are not presented in the following tables as it is assumed that if the MT is achieved then the corresponding EPO will also be achieved.

## 5.1. Benthic Communities and Habitat

The (Tier 1) management actions to minimise potential impacts on the environmental factor 'Benthic Communities and Habitat' are presented in Table 6.

Table 6 Management actions to minimise impacts on Benthic Communities and Habitats

| Environmental Factor | Benthic Communities and Habitats |
|---|---|
| **Activity** | Dredging and return water discharge |
| **Potential Impacts** | • Direct loss of BCH due to dredging activities<br>• Indirect impacts of BCH due to reduction in available light caused by increase in suspended sediments released into the water column during dredging<br>• Turbidity impacts on BCH arising from return water discharge |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| Dredging operations do not occur outside the dredge footprint as spatially defined in **Figure 1** | 1.1 | Employ high-resolution positioning system to control dredge operations | Contractor | • Inspection and calibration of vessel positioning system.<br>• Dredge reports submitted throughout works period<br>• Hydrographic surveys conducted during dredging program | • Calibration prior to commencement of dredging<br>• Position reporting daily throughout dredging<br>• Hydrographic surveys conducted weekly (Quantum Surveys) and pre and post dredge Class-A surveys (PHS) | • Cessation of dredging and relocation of dredge; and<br>• Servicing and calibration of positioning system |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| No detectible reduction baseline condition of BCH outside the dredge footprint as spatially defined in **Figure 1**. | 1.2 | Implement the BCH Monitoring Program described in Section 6.1. | Proponent | • Pre-dredging BCH survey report<br>• Post-dredging BCH survey report | • Pre-dredging survey at least one month prior to commencement of dredging<br>• Post-dredging survey conducted within two months of completion of dredging program. | • If dredging results in a detectable reduction in BCH condition then annual surveys are required to satisfy the Performance Assessment Criteria outlined within Table 15. Further contingency management measures are outlined in Section 6.1.6. |
| | 1.3 | Conduct daily dredge plume sketches and assess against nearest sensitive receptor as described in Section 6.1 and identified in Figure 6. | Contractor | • Dredge reports submitted throughout works period | • Daily during dredging operations at agreed time with proponent | • If visible plumes exceed the Performance Assessment Criteria outlined within Table 15 contingency management measures will be implemented in accordance with Section 6.1.6. |
| | 1.4 | Ensure dredge anchoring operations do not impact adjacent sensitive receptors to dredge footprint as spatially defined in Figure 1 | Contractor | • Dredging contractors safe work method statements<br>• Dredge reports submitted throughout works period<br>• Post-dredging BCH survey report | • Throughout all dredging operations | • MWPA to determine if further BCH surveys are required<br>• Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated |

## 5.2. Marine Environmental Quality

The (Tier 1) management actions proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in Table 7.

Table 7 Management actions to minimise impacts on Marine Environmental Quality

| Environmental Factor | Marine Environmental Quality |
|---|---|
| **Activity** | Dredging and return water discharge |
| **Potential Impacts** | • Localised turbidity increases from dredging<br>• Tailwater discharge resulting in increased turbidity<br>• Tailwater discharge resulting in release of contaminants<br>• Tailwater discharge resulting in nutrient enrichment<br>• Hydrocarbon Spills (Vessel and Plant Operations) |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| A 'Low Level of Ecological Protection' shall be maintained at point of dredge return water discharge as spatially defined in Figure 5 and will return to a 'Moderate Level of Ecological Protection' within one month following cessation of discharge. | 2.1 | Implement the Marine Environmental Quality Monitoring Program (MEQMP) described in Section 6.2. | Proponent | • Water Quality Monitoring summary report | • Pre-dredge (minimum of two weeks)<br>• During dredge (continuous throughout)<br>• Post Dredge (minimum of one month) | • If dredging results in any exceedances of the Trigger Levels outlined within Table 17 and Table 18 contingency management measures will be implemented in accordance with Section 6.2.6. |
| | 2.2 | Routine communication with Geraldton Fisherman's Cooperative (GFC) | Proponent | • GFC water quality sensors | • During dredging adjacent to GFC water intakes:<br>• Continuous monitoring | • If dredging alters water quality at the GFC water intakes, and triggers sensors within the facility, contingency management measures will be implemented in agreement with the GFC operations manager in accordance with the Project Risk Assessment. |
| | 2.3 | Inspections of all dredge equipment | Contractor | • Vessel and Site Environment | • Prior to the commencement of dredging | • Cease works if significant spillage or damage observed |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| | | and pipelines to check for leaks or damage | | Safety and Health inspection checklist | • Daily throughout dredging | • Activate spill response actions (control drainage, clean up) as required; and<br>• Undertake incident investigation and implement recommendations<br>• Continue MWQMP |
| | 2.4 | Deploy and maintain silt curtain around tailwater outfall pipes | Proponent | • Dredge reports submitted throughout works period | • Prior to and post tailwater discharge | • Alter deployment location<br>• Alter the deployment method<br>• Continue to implement the MEQMP |
| | 2.5 | No disturbance of previously dredged sediment buried below the water table during reclamation or construction activities | Contractor | • Dredging and Construction contractors MWPA approved environmental management documentation<br>• Dredge reports submitted throughout works period<br>• MWPA surveillance | • Throughout entire Project lifecycle | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated<br>• Assess whether marine environmental quality sampling is required at the LEPA/MEPA boundary for contaminants and nutrients |

## 5.3. Air Quality

The (Tier 1) management actions proposed to minimise potential impacts on the environmental factor 'Marine Environmental Quality' are described in Table 8.

Table 8 Management actions to minimise impacts on Air Quality

| Environmental Factor | Air Quality |
|---|---|
| **Activity** | Earthworks and reclamation activities |
| **Potential Impacts** | • Earthworks occurring at the Berth 7 DMPA<br>• Windblown dust from unsealed reclaim<br>• Vehicle and plant movements at the Berth 7 DMPA |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| Particulates as PM10 remains below 50ug/m3 averaged over 24hr, as recorded at the Connell Road real time dust monitor (TEOM). | 3.1 | Implement the Dredging and Construction contractors MWPA approved environmental management documentation | Contractor | • Dredge reports submitted throughout works period | • Ongoing throughout construction, dredging and land reclamation activities | • Water cart available on site to maintain moisture content<br>• Reclamation area capped with gravel as soon as practicable after placement of dredge material<br>• Moisture content of dredge material maintained until compacted and capped<br>• Capping material stockpiled on site prior to dredge material being pumped into reclamation area.<br>• MWPA visual surveillance |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| | 3.2 | Implement Air Quality Monitoring in accordance with the current MWPA Air Quality Monitoring Sampling and Analysis Plan | Proponent | • Daily assessment against define Trigger Levels<br>• Quarterly Air Quality report | • Daily | • Water cart available on site to maintain moisture content<br>• Reclamation area capped with gravel as soon as practicable after placement of dredge material<br>• Moisture content of dredge material maintained until compacted and capped<br>• Capping material stockpiled on site prior to dredge material being pumped into reclamation area.<br>• MWPA visual surveillance |

## 5.4. Marine Fauna

The (Tier 2) management actions proposed to minimise potential impacts on Marine Fauna are described in Table 9.

Table 9 Management actions to minimise impacts on marine fauna.

| Environmental Factor | Marine Fauna |
|---|---|
| **Activity** | Dredging operations |
| **Potential Impacts** | • Injury or death of marine fauna as a result of dredge operations<br>• Injury or death of marine fauna due to vessel movement (strike)<br>• Disturbance to juvenile rock lobster and/or whale migration<br>• Water quality impacts on marine fauna |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| No reported incidences of marine fauna injury or death as a result of water quality impacts. | 4.1 | Implement the Marine Environmental Quality Monitoring Program (MEQMP) described in Section 6.2. | Proponent | • Water quality monitoring summary report | Pre-dredge:<br>• Minimum of two weeks<br>During dredge:<br>• Continuous throughout<br>Post Dredge:<br>• Minimum of one month | • Consider requirement for additional BCH monitoring or water quality sampling if post dredge data assessment indicates potential impacts from tailwater return. |
| No reported incidences of marine fauna injury or death as a | 4.2 | Implement a soft start procedure prior to commencing operations. | Contractor | • Dredge reports submitted throughout works period | • Each occasion, prior to activating dredge cutter head and suction. | • Dredge operations not to commence unless a soft start procedure has been implemented. |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| result of dredge operations | 4.3 | All project vessels are to have at least one crew member approved and inducted by MWPA as a Marine Fauna Observer (MFO) on board at all times. | Contractor | • MWPA MFO induction sign off | • Prior to commencement of dredging. | • Dredge operations not to commence unless at least one crew member is an MWPA recognised trained MFO. |
| | 4.4 | MFO logs to be complete during all dredge operations. | Contractor | • MFO logs. | • Daily whilst dredge operations are occurring. | • Investigate quality of MFO logs, or why logs were not complete, and ensure adequate staff and resources are in place to fulfil requirement. |
| | 4.5 | Dredge operations are to cease if:<br>• Whales are observed within 100 m of the dredge vessel and at risk of collision; or<br>• Dolphins, sealions [2]or turtles are observed and at risk within 50 m of the dredge vessel. | Contractor | • MFO logs,<br>• Daily dredge logs. | • For the duration of dredging. | • Investigate why dredge operations were not ceased and apply required correction actions. |
| | 4.6 | Incident report to be complete if any marine mega fauna (whale, turtle, dolphin, sealion etc) remains are observed within the dredge equipment or placement site. | Contractor | • Site ES&H inspection checklist. | • As required. | • Investigate fauna death and apply required corrective actions and or modifications to dredge operations. |

[2] Note Sealines hauled out on adjacent rock wall or reclaim areas are not considered at risk and do not trigger a cease in operations

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| No reported incidences of marine fauna injury or death as a result of vessel strike | 4.7 | All project vessels are to have at least one crew member trained as a MFO on board at all times. | Contractor | • MWPA MFO induction sign off | • Prior to commencement of dredging. | • Dredge operations not to commence unless at least one crew member is an MWPA recognised trained MFO. |
| | 4.8 | All construction vessels to operate at a speed under 8 knots at all times during the project. | Contractor | • Vessel GPS monitoring system<br>• MWPA harbour master management and monitoring. | • Continuous throughout vessel operations. | • Investigate why vessel was recorded in excess for the defined speed limit and amend vessel operations and activities as appropriate. |

## 5.5. Introduced Marine Pests

The (Tier 2) Management actions proposed to minimise potential impacts associated with introduced marine pests are described in Table 10.

Table 10 Management actions to minimise the risk of introduced marine pests

| Environmental Factor | Introduced Marine Pests |
|---|---|
| **Activity** | Vessel mobilisation to site |
| **Potential Impacts** | • Translocation of introduced marine pests to the environment adjacent to the project area |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| Manage vessel activities to prevent the introduction of introduced marine pests into and within State waters. | 5.1 | All interstate and overseas vessels that mobilise to the project site are required to complete the Department of Primary Industry and Regional Development (DPIRDs) Vessel Check 2.0 assessment. | Contractor | • A copy of the Vessel Check 2.0 report is to be submitted to MWPA for assessment along with any supporting documentation including antifoul certificates and inspection reports. | • Prior to dredge entering Western Australian Waters from overseas or interstate. | • Vessel not to enter Western Australia without approved Introduced Marine Pest documentation |
| | 5.2 | Adhere with MWPA's Marine Pest Management procedure (HSE-PR0-022). | Contractor | • A copy of the Vessel Check 2.0 report is to be submitted to MWPA for assessment along with any supporting documentation including antifoul certificates and inspection reports. | • Prior to dredge vessels entering Australian waters or mobilising to the Port of Geraldton until all dredging operations have ceased. | • Implementation of contingency measures as required by MWPA and Department of Fisheries quarantine requirements. |
| | 5.3 | All vessels that mobilise to the project site from within Western Australia are required to advise MWPA of previous operating | Contractor | • Details of previous working locations and marine pest measures to be submitted to MWPA for assessment along with any supporting information. | • Prior to dredge vessels mobilising to the Port of Geraldton. | • Implementation of contingency measures as required by MWPA. |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| | | locations within the past 3 months and any measures undertaken to manage marine pests | | | | |
| | 5.4 | Continue to implement the MWPA marine pest monitoring program | Proponent | • Annual report | • Biannual | • Implementation of contingency measures as required by MWPA and Department of Fisheries quarantine requirements. |

## 5.6. Hydrocarbon and Chemical Management

The (Tier 2) Management actions proposed to minimise potential impacts associated with hydrocarbon and chemical pollution are described in Table 11.

Table 11 Management actions to minimise the risk of hydrocarbon pollution

| Environmental Factor | Introduced Marine Pests |
|---|---|
| **Activity** | Dredging, refuelling and plant operations |
| **Potential Impacts** | • Hydrocarbon release into the marine or terrestrial environment from a vessel spill, during refuelling or plant operations |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| Manage vessel and plant operations, refuelling, chemical storage and spill response to ensure no adverse impacts to the environment. | 6.1 | Comply with MWPA's vessel bunkering procedure and permit system during operations | Contractor | • Vessel management procedures<br>• The proponent is to be notified immediately in the event of a hydrocarbon spill of any volume to water | • Prior to commencement of dredging | • Dredge operations not to commence prior to development and approval of vessel management procedures.<br>• Investigate spill event and review management actions and responses |
| | 6.2 | Comply with MWPA's hydrocarbon storage and management procedure and permit system during plant and construction operations | Contractor | • Dredging and Construction contractors MWPA approved environmental management documentation<br>• The proponent is to be notified immediately in the event of a hydrocarbon spill of any volume to water | • Prior to commencement of construction or reclamation activities | • Dredge operations not to commence prior to development of Dredging and Construction contractors MWPA approved environmental management documentation<br>• Investigate spill event and review management actions and responses |
| | 6.3 | Document vessel bunkering management, including appropriately licensed bunkering services | Contractor | • Vessel management procedures | • Prior to commencement of dredging | • Dredge operations not to commence prior to development and proponent approval of vessel bunkering management procedure |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| | 6.4 | Undertake vessel maintenance and bunkering in accordance with dredging contractors approved vessel bunkering management systems/plans/procedures | Contractor | • Vessel management procedures | • For the duration of dredging | • Vessel bunkering management systems to be reviewed and refined (if required) in the event of an identified procedural breach or hydrocarbon spill |
| | 6.5 | Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation and spill response) | Contractor | • Vessel management procedures<br>• Dredging and Construction contractors MWPA approved environmental management documentation<br>• The proponent is to be notified immediately in the event of a hydrocarbon spill of any volume to water | • Prior to commencement of dredging or reclamation activities | • Dredge or reclamation activities not to commence prior to development and approval of all required operational procedures.<br>• Investigate spill event and review management actions and responses |
| | 6.6 | Undertake an environmental inspection of dredging vessel | Proponent | • Environmental Audit report | • Prior to, or during, dredging | • Contractor to update documentation or address management based on MWPA audit findings |

## 5.7. Waste Management

The (Tier 2) Management actions proposed to minimise potential impacts that waste pollution may have on the environment are listed in Table 12.

Table 12 Management actions to manage waste

| Environmental Factor | Introduced Marine Pests |
|---|---|
| **Activity** | Incorrect or accidental disposal of liquid or solid waste from a vessel |
| **Potential Impacts** | • Impacts on the marine environmental quality (both sediment and water) due presence of foreign materials<br>• Decrease in viability of flora and fauna at species and population levels due to excess waste in water column<br>• Marine and terrestrial pollution from waste emissions or plastics |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| Manage disposal systems in compliance with requirements for MWPA and in accordance with MARPOL 73/78 Convention Annex IV (sewage) and Annex V (garbage). | 7.1 | Dredging contractor to establish a sewage and garbage disposal plan in accordance with MWPA and MARPOL 73/78 | Contractor | • Within 12 hours of a reportable incidence | • Duration of dredging operations | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated. |
| Manage the correct onshore disposal and reporting systems | 7.2 | Biosecurity Controlled Wastes (e.g. Garbage) from international commercial vessels must be managed in | Contractor | • Consent from appropriate avenues needs to be obtain before correct disposal of waste | • Duration of dredging operations | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated.<br>• Reporting to regulator in accordance with Biosecurity Regulation 2016. |

| Management Targets | Management Actions | | Environmental Performance | | | |
|---|---|---|---|---|---|---|
| | Item | Actions | Responsibility | Reporting/Evidence | Timing | Contingency |
| | | accordance with the Australian *Biosecurity Regulation* 2016 and MWPA procedures. | | | | |
| | 7.3 | Only a licenced Controlled Waste Carrier to be used for any controlled waste discharged ashore | Contractor | • Controlled waste tracking forms to be completed as soon as possible | • Duration of dredging operations | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated |
| | 7.4 | All forms of waste need to be stored in appropriately labelled drums or tanks and be correctly disposed of and not discharged to the environment | Contractor | • Approval certification and tracking forms to be completed as soon as possible | • Duration of dredging operations | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated |
| | 7.5 | Reporting of any type of spillage within the marine environment directly to the MWPA Harbour Master | Contractor | • Within 12 hours of reportable | • During the duration of dredging operations | • Incident to be raised in accordance with MWPA incident management procedures and investigation required with corrective actions to ensure action is not repeated |

# 6. Monitoring

To ensure that proposed management requirements outlined in Section 5 are adequate to minimise and reduce the potential environmental impacts, MWPA have designed a comprehensive environmental monitoring program. The monitoring is broken down into the following programs

1. Marine Environmental Quality Monitoring Program;
2. Benthic Communities and Habitat Monitoring Program; and
3. Air Quality Monitoring Program.

A summary and overview of these programs is presented in Table 13 and a detailed description of each in the ensuing sections.

Table 13 Monitoring Program Overview

| Element | Management Target | Frequency | Duration | Parameters | Methods | Sample Locations | Trigger for management action |
|---|---|---|---|---|---|---|---|
| **Benthic Communities and Habitat Monitoring Program** | | | | | | | |
| Benthic Communities and Habitat Monitoring Program | No detectible reduction from the baseline state of benthic communities outside of the dredge footprint as spatially defined in **Figure 1** | Prior to dredging and three months post dredging | Pre-dredge survey – Planned June 2022<br>Post-Dredge Survey planned Oct/Nov 2022 | • Percent coverage<br>• Species composition<br>• Habitat type<br>• Habitat extent | • Drop/tow camera survey | • 12 drop camera locations as presented in **Figure 6** | Refer **Table 15** |
| | | Daily during dredging | Throughout duration of dredging activities | • Daily dredge plume extent sketch | • Visual observation drawn onto sketch<br>• Digital photographs | • Dredge area and plume extent | Refer **Table 16, Table 17** and **Table 18** |
| **Marine Environmental Quality Monitoring Program** | | | | | | | |
| Marine Environmental Quality Monitoring | A 'Low Level of Ecological Protection' shall be maintained at point of dredge return water discharge as spatially defined in Figure 5 and will return to a 'Moderate Level of Ecological Protection' within one month following cessation of discharge. | Hourly in-situ measurements | Commencement prior to tailwater release.<br>Completion one month after last dredge sediments are relocated into reclaim. | • pH<br>• Dissolved Oxygen. | • In-situ data logger | • WQD1 at LEPA/MEPA boundary (**Figure 7**) | Refer **Table 7** |

| Element | Management Target | Frequency | Duration | Parameters | Methods | Sample Locations | Trigger for management action |
|---|---|---|---|---|---|---|---|
| Air Quality Monitoring Program | | | | | | | |
| Air quality monitoring program | Particulates as PM10 remains below 50ug/m3 averaged over 24hr, as recorded at the Connell Road real time dust monitor (TEOM). | Daily during project | Through all dredge material disposal and land reclamation activities | • Dust as PM10 | • Real time sampling using existing TEOMs at MWPA dust monitoring stations | • Existing MWPA dust monitoring stations | Refer Table 19 |

## 6.1. Benthic Communities and Habitat Monitoring

### 6.1.1. Rationale

Based on an understanding of impacts from previous dredging projects as presented within O2 Marine (2022a and 2022b) there are not predicted to be any '*irreversible loss*' or '*recoverable impacts*' as defined by EPA (2021a) associated with this dredge project. Therefore, a simple daily dredge plume sketch is the only reactive monitoring program developed to ensure no impacts on BCH will occur from dredge activities. Additionally, a pre- and post-dredge BCH health assessment is included to provide qualitative data to validate impact predictions.

Monitoring of dredge plume and BCH health pre- and post-dredging will be conducted to ensure that the EPOs for protection of BCH are achieved and the potential for light reduction from dredge plumes are adequately managed.

### 6.1.2. Monitoring Locations & Frequency

#### Daily Plume Sketches

Dredge plume sketches will be conducted daily to assess the extent of visible plumes throughout the duration of dredging activities. This will include sketching the visual dredge plume onto the monitoring proforma (Appendix B) and collecting representative digital photographs.

#### BCH Monitoring Program

BCH monitoring will be conducted at all 12 locations as presented within Table 14. BCH monitoring will be conducted as follows:

- Pre-dredge – June/July 2022; and
- Post-dredge – October/November 2022 and annually until EPOs achieved (if required).

Table 14 monitoring location coordinates (GDA94 MGA50)

| Site ID | Easting | Northing |
|---|---|---|
| DC1 | 264826 | 6815234 |
| DC2 | 264953 | 6815232 |
| DC3 | 265089 | 6815200 |
| DC4 | 264807 | 6815292 |
| DC5 | 264942 | 6815299 |
| DC6 | 265126 | 6815284 |
| DC7 | 264774 | 6815368 |
| DC8 | 264936 | 6815377 |
| DC9 | 265141 | 6815371 |
| DC10 | 264185 | 6815044 |
| DC11 | 265288 | 6815927 |
| DC12 | 263792 | 6814472 |

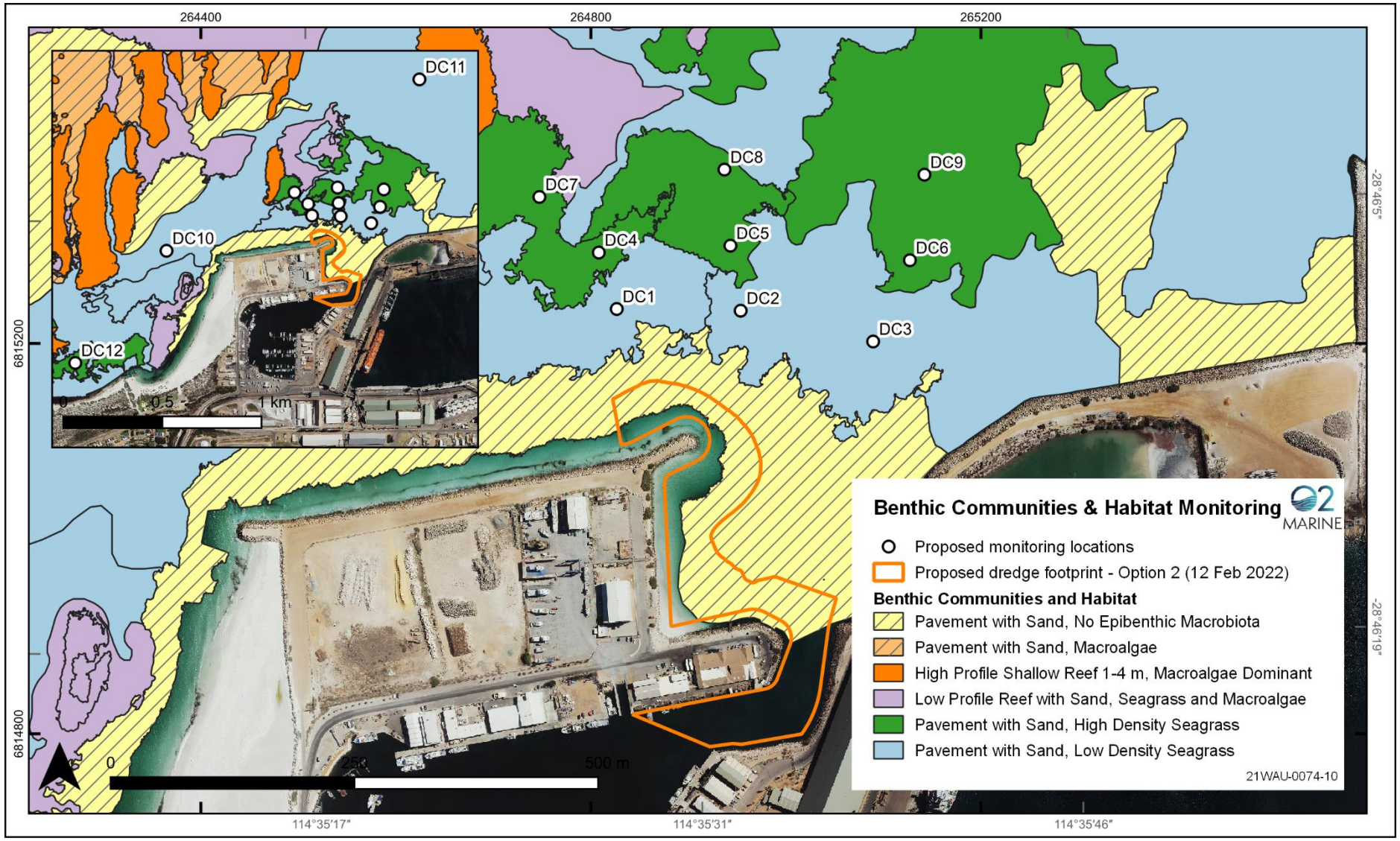


Figure 6 Proposed BCH monitoring locations.

### 6.1.3. Environmental Protection Outcomes, and Performance Assessment Criteria

The EPOs and performance assessment criteria to be applied for protection of BCH are presented in Table 15.

Daily dredge plume sketches will be attached and submitted with the weekly dredging report to the MWPA project manager, whilst a BCH health monitoring summary report shall be prepared to document the BCH monitoring program as described in Table 21.

Table 15 Performance assessment criteria for BCH monitoring programs

| Daily plume sketches and BCH monitoring locations as per Figure 6 | |
|---|---|
| Performance Measure:<br>Early warning for no negative change from baseline state on BCH | Performance Assessment Criteria 1 |
| | Visible dredge plume from dredge activities extends over nearest sensitive receptor, as identified in Figure 5. |
| Management Target:<br>No detectible reduction from the baseline state of BCH | Performance Assessment Criteria 2 |
| | Visible dredge plume from dredge activities extends over nearest sensitive receptor for six consecutive days<br>and/or<br>Significant community shift related to dredging observed between pre- and post-dredge monitoring |
| Environmental Protection Outcome:<br>No detectible reduction from the baseline state of BCH | Performance Assessment Criteria 3 |
| | Annual BCH monitoring identifies recovery from observed impacts > 5 years |

### 6.1.4. Parameters and Procedures

#### Daily Plume Sketches

A plume monitoring pro-forma will be used to undertake a daily plume assessment of both the dredge and return water sites. Monitoring should be undertaken from an elevated area to determine the extent of any dredge related plume beyond the HEPA/MEPA boundary (as spatially defined in Figure 5). Additional information recorded will include a daily photograph, wind conditions (strength and direction) tidal behaviour (direction), ambient weather conditions, time and date. A plume monitoring pro-forma is included as Appendix B. The plume monitoring pro-forma is to be submitted to the dredging superintendent daily.

#### BCH Monitoring Program

BCH monitoring will be completed using drop/tow camera at the monitoring locations presented within Table 14 and Figure 6. Parameters and procedures for BCH monitoring using drop/tow camera will be in accordance with or to the same standard as the methods described by O2 Marine 2022b.

### 6.1.5. Data Analysis

#### BCH Monitoring Program

Field data collected from drop/tow camera will be validated post-hoc to determine habitat type and condition for each site. A similar approach will be used for post-dredge data capture to provide the ability to undertake a pre- and post-dredge habitat interrogation to determine if the EPOs and MTs have been achieved.

A final summary report shall be prepared to document the findings from BCH surveys.

### 6.1.6. Corrective Actions

Daily Plume Sketches

Completed daily dredge plume proformas and digital photos will be assessed weekly by the MWPA dredging project manager and assessed against the Performance Assessment Criteria as presented in Table 15. Where an exceedance of Performance Assessment Criteria occurs the following management actions will be explored and implemented as required to ensure the EPO is achieved:

- Reduce dredging rates; and
- Relocate the dredge vessel further away from sensitive receptors;

If at any time Performance Assessment Criteria 2 is exceeded, dredging operation shall cease until the visible dredge plume completely dissipates.

BCH Monitoring Program

The post-dredge BCH survey results will present an assessment against the Performance Assessment Criteria presented within Table 15. If Performance Assessment Criteria 2 is achieved, then the EPO is considered met and no further monitoring is required.

If Performance Assessment Criteria 2 is not achieved, then annual monitoring should continue until recovery to pre-dredging baseline conditions are observed. If recovery has not been observed within five years, the EPO is not considered achieved.

If the EPO is not met, an investigation is required to determine the severity and extent of related impacts and management actions identified to ensure no future impacts from dredging and material placement arise. If the dredge project is identified as having significant environmental impacts, MWPA may consider consultation with the EPA branch within DWER to consider future corrective actions.

## 6.2. Marine Environmental Quality Monitoring Program (MEQMP)

### 6.2.1. Rationale

Monitoring of marine water quality will be undertaken to ensure that the EPOs and MTs for protection of marine environmental quality are achieved and the potential for contaminants to be released from return water are adequately assessed. Based on the low level of risk identified to marine environmental quality the sampling program will have both a routine and a reactive component.

The routine monitoring program is based on validating the predicted impacts and uses during-dredging and post-dredging in-situ data logging on the LEPA/MEPA boundary (Figure 7). In situ logging is based around measuring pH and dissolved oxygen (DO) as proxies to determine if there have been any acid sulfate soils occurring during sediment relocation into the Berth 7 DMPA.

A reactive monitoring program has been designed which may be implemented if the routine monitoring program identifies any potential impacts from soil acidification within the Berth 7 DMPA. The reactive monitoring program is based on collection of water samples being collected on the LEPA/MEPA, MEPA/HEPA and within the HEPA (Figure 7). Water samples will be analysed under laboratory conditions to determine the presence/absence of

contaminants that may be mobilised from existing sediments and groundwater as a result of soil acidification within the Berth 7 DMPA.

This combination of sampling approach provides flexibility and a risk based approach to ensure that the MTs and EPOs are achieved. The EPOs, MTs and associated management actions were adopted assuming the potential for a temporary, localised reduction in marine environmental quality in the immediate vicinity of the return water discharge. This is spatially presented as the LEPA in Figure 5.

### 6.2.2. Monitoring Locations & Frequency

Routine monitoring will be conducted at WQD1 with data recorded at hourly intervals. Data will be sampled at the following frequency:

- During dredging – immediately prior to and up to the completion of dredging; and
- Post dredging – one month after dredging is completed.

If required, the reactive monitoring program will be conducted at all four sample locations with sampling conducted weekly for one month, or until the EPO is achieved.

Routine and reactive monitoring sample locations are presented in Figure 7 and Table 16.

Table 16 Marine water quality sample location details and coordinates (GDA94 MGA50)

| Site ID | Site | Type | Easting | Northing |
|---|---|---|---|---|
| WQD1 | Data logging and Water Sampling | Routine and reactive | 265265 | 6814854 |
| WQ2 | Water Sampling | Reactive | 265808 | 6815192 |
| WQL3 | Water Sampling | Reactive | 263823 | 6814599 |
| WQ4 | Water Sampling | Reactive | 264389 | 6818655 |

### 6.2.3. Environmental Protection Outcomes, Management Targets and Trigger Levels

The EPOs, MTs, Trigger Levels and Management Target to be applied for protection of marine environmental quality are presented in Table 17 for routine sampling and Table 18 for reactive sampling.

A tiered management approach has been developed based on monitoring and reporting against the Trigger Levels for routine monitoring and Management Target for reactive monitoring to ensure the EPOs and MTs for the protection of marine environmental quality are achieved (Figure 8 ).

A water quality close out report shall be prepared to document the MEQMP program as described in Table 21.

Table 17 Trigger Levels for marine water quality monitoring – Routine Monitoring

| Monitoring Location: WQD1 | |
|---|---|
| Management Target:<br>Moderate Level of Ecological Protection | Trigger Level 1 – Daily averages over two consecutive sampling dates |
| | pH: <6.0<br>DO: < 60% saturation |
| Environmental Protection Outcome:<br>Moderate Level of Ecological Protection achieved after one month post dredging | Trigger Level 2 – Daily averages for final week of post dredge sampling period |
| | pH: < 7.0<br>DO: < 70% saturation |

Table 18 Trigger Levels for marine water quality monitoring – Reactive Monitoring

| Monitoring Location: WQD1, WQ2, WQL3 and WQ4 | |
|---|---|
| Environmental Protection Outcome:<br>Moderate and High Level of Ecological Protection achieved after one month post dredging | Management Target 1 – One month after cessation of harbour dredging and tailwater return |
| | WQD1 - Contaminant concentrations exceed the ANZG (2018) 90% Species Protection Levels<br>or<br>WQ2 - Contaminant concentrations exceed the ANZG (2018) 99% Species Protection Levels or comparison against background levels (WQL3 & WQ4) |

### 6.2.4. Parameters and Procedures

#### Routine Monitoring Program

A pre-calibrated water quality data logger will be used to measure and record physico-chemical water quality data at site WQD1 (Figure 7). The data logger will record pH and DO as a minimum, hourly throughout the duration of the sampling period.

The data logger is required to be calibrated and serviced in accordance with the manufacturer's specifications throughout the duration of the project to ensure data collected are accurate.

#### Reactive Monitoring Program

If required, water samples will be collected at all four sampling locations presented in Table 16. Water samples will be collected using a depth-integrated water sampler[3] to pump the required volume of water evenly from the water column between 0.5 m below the surface to 0.5 m above the seabed. The water sampler should be rinsed with Decon solution (or equivalent) between samples to ensure no cross contamination. Water samples will be

[3] If a depth-integrated water sampler is not available, a pole sampler or niskin bottle (or equivalent) may be used to sample at a depth of 0.5m below the surface. Near-surface sampling is generally considered to be representative of water quality at the sample sites as waters in Geraldton Port experience a moderate degree of mixing.

collected into suitable (laboratory supplied) bottles and immediately stored on ice for transport to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

All sample containers will be marked with a unique identifier, the date/time and the sampler's name and clarification that the samples are marine water using a waterproof permanent maker. All samples will be analysed for a minimum of:

- Dissolved metals to include Al, As, Cd, Cr, Cu, Pb, Mn, Ni, Zn, Hg; and
- Nutrients (Total N, TKN, NH3, NOx-N).

### 6.2.5. Data Analysis

#### Routine Monitoring Program

Raw hourly physicochemical parameter data will be processed post dredge to include removal of outlier data points and smoothing applied, as required, based on post deployment calibration requirements. Daily averages will be calculated and compared to the performance criteria presented in Table 17. Where any exceedance is identified corrective actions will be investigated in accordance with Section 6.2.6.

For reporting purposes data will be interrogated and presented within tables and timeseries graphs with an assessment against the performance criteria presented in Table 17 presented for the entire sampling period.

#### Reactive Monitoring Program

If required, laboratory reported water sample results will be tabulated weekly and assessed against Management Target 1 presented in Table 18. Where any exceedance is identified corrective actions will be investigated in accordance with Section 6.2.6. Any assessment should consider sampling results from the reference sites (WQL3 and WQ4) when considering whether results have exceeded Management Target 1.

For reporting purposes data will be interrogated and presented within tables with an assessment against Management Target 1 presented in Table 18 presented for the entire sampling period.

### 6.2.6. Corrective Actions

#### Routine Monitoring Program

At the completion of the during dredge data logging period, data will be uploaded and analysed in accordance with Section 6.2.5 along with assessment against Trigger Level 1. If Trigger Level 1 is exceeded the following will occur:

- Redeploy the data logger for the post-dredge sample period;
- Consider if the reactive monitoring program should be conducted to facilitate further assessment against the MTs and EPOs; and
- Assess management options in accordance with Figure 8.

At the completion of the post dredge data logging period, data will be uploaded and analysed in accordance with Section 6.2.5 along with assessment against Trigger Level 2. If Trigger Level 2 is exceeded the following will occur

- Implement the reactive monitoring program until the EPO is achieved; and
- Assess management options in accordance with Figure 8.

### Reactive Monitoring Program

Water quality sample data shall be reviewed immediately upon receipt of laboratory results against Management Target 1 to determine if the EPO is met. Management Target 1 has been included to assess the rate of return of water quality post dredging to MEPA (90% SPLs) and HEPA (99% SPLs) within the inner harbour and assigned to all other waters, respectively. The EPO requires this is achieved within one month post completion of dredging and tailwater release. Management Target 1 is breached if the assigned SPLs are not achieved within the first month of sampling. The target is considered met once two consecutive monitoring events meet the assigned SPL criteria and monitoring can cease.

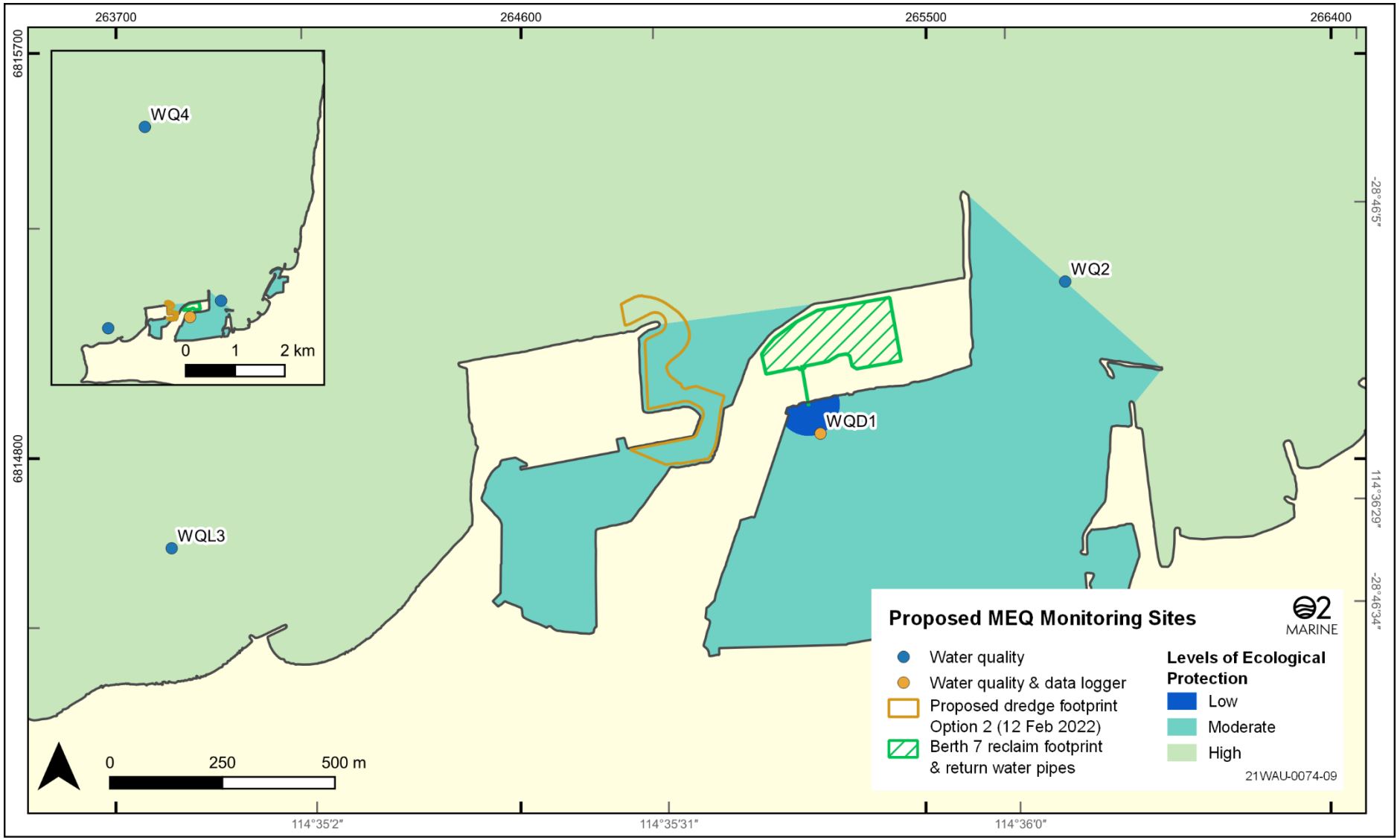


Figure 7 Proposed water quality monitoring locations

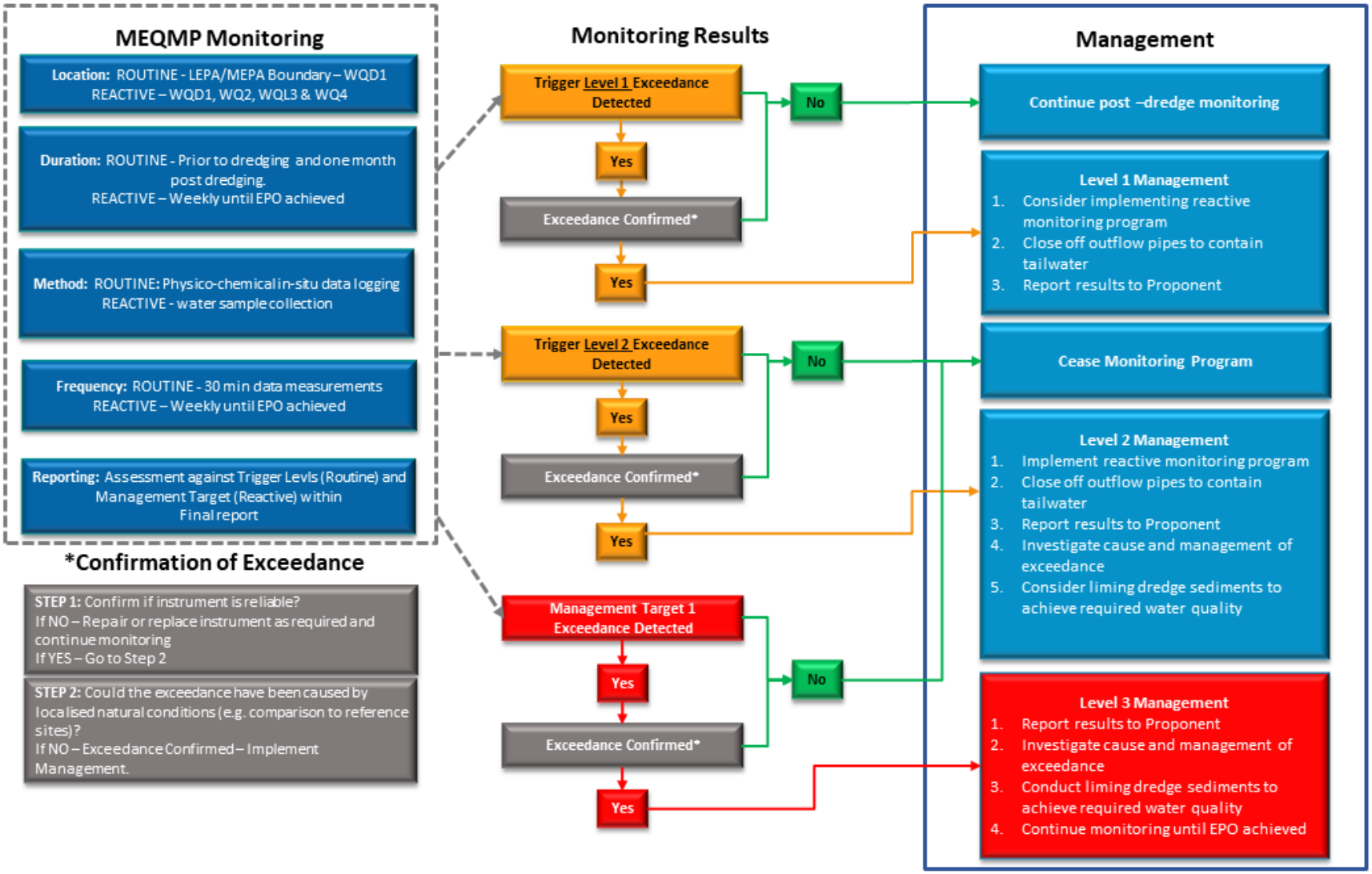


Figure 8 Tiered management response for marine water quality monitoring

## 6.3. Air Quality Monitoring Program

### 6.3.1. Rationale

Monitoring of air quality will be undertaken to ensure that the EPOs and MTs for protection of air quality are achieved and the potential for fugitive dust emissions to be released during land reclamation activities or uncapped dredge sediments are adequately managed. The monitoring approach requires hourly and daily averaged in-situ monitoring of air quality as $PM_{10}$ at Connell Road. Connell Road is an existing air quality monitoring station MWPA have established for ongoing, routine compliance monitoring in accordance with Environmental Licence L4275/1982/15. The EPOs, MTs and associated management actions were adopted assuming the potential for unmanaged dust emissions to become a nuisance for other Port users and potentially cause compliance monitoring issues under the Environmental Licence. For further details on the MWPA routine environmental licence air quality sampling please refer to the Air Quality Monitoring Sampling and Analysis Plan (MWPA 2022).

### 6.3.2. Monitoring Locations and Frequency

Air quality monitoring is sampled at four air quality monitoring stations with measurements recorded every ten-minutes throughput the Project. For the purposes of this project Connell Road sampling station is the closest and most likely to provide any indication of project air quality impacts, although other monitoring station, depending on wind direction, may also be analysed as required. Further details for Air Quality Monitoring locations and frequency are detailed within the Air Quality Monitoring Sampling and Analysis Plan (MWPA 2022).

### 6.3.3. Environmental Protection Outcomes, Management Targets and Trigger Levels

The EPOs, MTs and trigger levels to be applied for protection of air quality are presented in Table 19.

Table 19 Trigger Levels for air quality monitoring

| **Monitoring Location: Connell Road Dust Monitoring Station** | |
|---|---|
| Early Warning:<br>No contribution to dust levels from land reclamation activities | Trigger Level 1 – Instantaneous $PM_{10}$ |
| | No PM10 triggered automated alerts from EnviroSuite<br>and<br>Wind direction not predominantly from the northeast. |
| Management Target:<br>Particulates as PM10 remains below 50ug/m3 averaged over 24hr, as recorded at the Connell Road real time dust monitor (TEOM). | Trigger Level 2 – Daily Averaged $PM_{10}$ |
| | PM10 <50 µg/$m^3$ averaged over 24hr<br>and<br>No complaints from Port Users |

### 6.3.4. Parameters and Procedures

Air quality monitoring will be sampled as $PM_{10}$ as reported from existing Tapered Element Oscillating Microbalance (TEOM) air quality monitoring infrastructure. Wind speed and direction are also collected and will be used to interpret air quality data. Sampling parameters and procedures will be in accordance with those outlined within Air Quality Monitoring Sampling and Analysis Plan (MWPA 2022).

### 6.3.5. Data Analysis

MWPA employ a customised software package to assist with analysis and interpretation of real time TEOM air quality and wind speed and wind direction data. This software continually interrogates real time TEOM data and sends out automated alerts when an exceedance of the following triggers are exceeded:

Alerts triggered by instantaneous measurements:

- Alert Level 1 - instantaneous (5min) dust concentration above 200ug/m3, Or
- Alert Level 1 - short term (2hr) dust concentration above 100ug/m3.

Alerts triggered by Time Weighted Averages (TWA):

- Alert Level 2 TWA above 25ug/m3 before midday, and
- Alert Level 3 TWA above 40ug/m3 before 6pm.

Alerts are sent to MWPA operational personnel who interrogate real time wind speed and direction data to identify if the source of the exceedances is Port related (TEOM is downwind of Port activities) or regional (TEOM is not downwind of Port activities or all TEOM are exceeding). Based on the outcome of the investigation the source of the dust exceedance is identified and further action is applied where the source is identified as Port related.

### 6.3.6. Corrective Actions

Trigger Level 1 is considered to be exceeded where automated alerts have been issued and the wind speed and direction data identify land reclamation activities occurring upwind. In this instance the contractor will be notified, site inspection will be conducted by the proponent and appropriate actions are required to be discussed with MWPA and implemented to reduce further fugitive dust emissions.

Management actions may include:

- Temporary suspension of earthworks until wind conditions improve, or
- Improved material conditioning, placement and moisture management.

Trigger 2 is considered to be exceeded where the daily averaged $PM_{10}$ exceeds and 50 µg/$m^3$ and Trigger 1 investigations identified land reclamation as contributing to concentrations recorded at the air quality monitoring station. Trigger 2 is considered to represent an incident and will require a formal incident investigation to be conducted in accordance with the HSE-PRO-005 Incident Management Procedure. Corrective actions will be required to be identified and implemented to ensure no further exceedances of Trigger Level 2 occur.

Management actions may include:

- Suspension of earthworks,
- Use of additional dust suppression techniques, or
- Capping fine material with compacted aggregates (gravel).

# 7. Reporting

A summary of the reporting requirements for the project are provided in Table 20.

Table 20 Project Reporting Requirements

| Report | Content | Timeframe | Responsible |
|---|---|---|---|
| Non-compliance Investigation Report | • Identify which Trigger Level has been breached or description of the operational incident event<br>• Describe the investigation being undertaken into the cause of the incident<br>• Identify any corrective or contingency management actions proposed to be implemented or being implemented | Within 7 days of determining that any Trigger Level has been exceeded or an Environmental Incident has occurred not been achieved | Contractor |
| Non-compliance Summary Report | • Identify which Environmental Protection Outcome has not been achieved<br>• Detail the monitoring results that identified the Environmental Protection Outcome was not being achieved<br>• Describe the investigation being undertaken into the cause of the Environmental Protection Outcome not being achieved<br>• Identify any corrective or contingency management actions proposed to be implemented or being implemented | Within 30 days of determining that any Environmental Protection Outcome has not been achieved | Proponent |
| Dredge and Construction Summary Reports | • Dredge operation log – (e.g. operations times, types of operations, GPS positioning, dredge volumes).<br>• Marine fauna observation Logs – (e.g. dredge operation time, name of observer, fauna species, distance/direction from vessel, management response)<br>• Maintenance Dredge Plume sketches and photos | Weekly during dredging and construction | Contractor |
| Site and vessel inspection checklists/logs | • Site Environment, Safety & Health inspection – (e.g. dredge pipe integrity, erosion, bund integrity, dust, drainage).<br>• Vessel Environment, Safety & Health inspection – (e.g. equipment inspection, navigation equipment systems, speed, MFO personnel, bunkering log). | As required under contract | Contractor |
| Dredging Close-out Report | • Statement of compliance with the relevant Environmental Protection Outcomes<br>• Comparison of the actual and predicted dredge-related pressures and resultant environmental impacts and effects | Within 3 months following the completion of dredging. | Proponent |

A summary of the additional reports that are expected to inform and demonstrate that the MTs have been met are listed in Table 21.

Table 21 Reporting requirements for environmental monitoring programs to determine if MTs are met

| Report | Content | Timeframe | Responsibility |
|---|---|---|---|
| Benthic habitat and communities pre- and post-dredge health assessment report | Summary of pre- and post-dredge BCH survey results discussion and analysis against Performance Assessment Criteria, EPOs and MTs. | Within five months following completion of dredging | Proponent |
| Marine environmental quality monitoring summary report | Summary of pre- and post-dredge MEQMP survey results discussion and analysis against Performance Assessment Criteria, EPOs and MTs. | Final report within two-months following cessation of dredging | Proponent |
| Air quality summary report | Inclusion of air quality data during dredging program combined into the Quarterly and Annual Air Quality reports. | In accordance with standard reporting commitments | Proponent |

A summary of the external reporting requirements for the project are provided in Table 22.

Table 22 External Reporting Requirements

| Report | Content | Timeframe | Recipient |
|---|---|---|---|
| Biosecurity Incident | Reporting potential, suspected or known marine pest incursion. | Within 24 hours of potential identification of marine pest incursion | DPIRD – FishWatch – 1800 815 507 |
| Major hydrocarbon spillage | Complete a POLREP - https://www.transport.wa.gov.au/imarine/reporting-marine-oil-pollution.asp | Immediately | DoT – MEER<br>(08) 6480 9924 |
| Major pollution incident | Details regarding the incident such as time, place, pollution type, severity, extent etc. | Immediately | DWER –<br>1300 784 782 |
| Significant Impact arising from project | There is no formal process for reporting significant environmental impacts. A report detailing the significant impact, technical investigations undertaken to support conclusions and all associated incident investigations and actions implemented to reduce the impact should be compiled for consultation. | Liaison should commence immediately upon identification of impacts.<br>Reports to be submitted upon completion. | Consultation with the EPA branch of DWER |

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# Appendix A. Existing Environment

## Appendix A.1. Coastal Processes

### A.1.1 Regional Setting

Geraldton is located within the Midwest region on the west coast of Western Australia, approximately 400 km north of Perth. The Port is located on the northern side of the Point Moore peninsula with the Port and city centre facing north into Champion Bay. Champion Bay is a semi-sheltered embayment protected from raw ocean swell conditions by a series of shallow subtidal reef systems extending off Point Moore and a deeper parallel limestone ridge which runs north towards Drummond Cove. East of the limestone ridge, water depths up to approximately 11 m occur within two kilometres of the coast. To the west of the limestone ridge, water depths rapidly increase to 20-30 m, and then gradually deepen to 50 m before shallowing again at the Houtman Abrolhos Islands located some 50 km offshore.

To the north and south of Point Moore, the coast is comprised primarily of sandy beaches generally overlying beach rock. Occasional areas of shallow beach rock and limestone platform are exposed at locations such as at Drummond Cove, Bluff Point, Point Moore and adjacent to the mouth of the Greenough River. Two main rivers, the Greenough River (~10 km south of Point Moore), and Chapman River (~5 km north of Point Moore), periodically discharge into coastal waters in the Geraldton area. These rivers are typically closed at the river mouth discharging only after significant rain falls within the two catchments.

### A.1.2 Climate and Oceanography

Offshore coastal waters, west of Champion Bay and Point Moore, experience moderate to high wave-energy. O2 Metocean (2021) undertook a metocean measurement programme on behalf of the City of Greater Geraldton in 2020. Waves, water levels, currents, and water temperature measurements collected at two sites distanced 1,100 m from each other, both approximately 500 m west of Sunset Beach foreshore in 10m water depth, were collected to improve the understanding of the metocean conditions contributing to beach change at Sunset Beach. Anticipating that most severe beach erosion would occur in winter, the measurement campaign commenced in March 2020 and extended to October 2020. Summer conditions were later added to the programme, with the summer measurement campaign lasting six (6) weeks from late November 2020 to early January 2021.

The significant wave height (Hs, total) at the measurement sites (10m depth) peaked at Hs~2.6m during a late May 2020 (winter) storm. The data revealed that Hs>2m is a relatively common occurrence during winter, where Hs>1.4m occurs approximately 30% of the time between June and October. Long period swells with peak spectral wave periods (Tp) longer than 20s were very rarely observed (<2%), however winter swells presented a peak period of 10<Tp<20s. Substantially more benign conditions were recorded in summer, with Hs>1.4m less than 1% of the time and Hs<1m 83% of the time.

The currents are tidally driven and predominantly parallel to the coast, rotating from northward to southward (and vice versa) with the tidal cycle. Depth averaged peak current speeds typically range from 0.10 to 0.20m/s in winter and rarely exceed 0.10m/s in summer. Only once during the measurement campaign the current exceeded 0.25m/s (May 2020 storm). Geraldton experiences diurnal tides with a small range (~0.9m spring).

Geraldton experiences a seasonal wind pattern on which is superimposed a diurnal land-sea breeze system. During winter, night and morning winds are generally moderate (6–30km/hr) and prevail from the north-east, then swing through north-west to south in the afternoon (URS 2001a). Summer morning winds are moderate (11–30km/hr) and generally originate from the east to south-east. In the afternoon the winds shift to moderate to strong (generally 21–40km/hr) through south to south-west (URS 2001). Typically, December is the windiest month and July the least windy. Extreme winds occur mainly in summer and generally are isolated events associated with thunderstorms and tropical cyclones (ATA 1994).

### A.1.3 Geomorphology

The Central West Coast Region is an area where the continental shelf is relatively narrow and there is a diversity of moderate energy coastal landforms developed. The coast is formed over the Perth Sedimentary basin. Through the Pleistocene (10,000 to 2,000,000 years ago) there was a succession of transgressions and regressions of the sea over the Swan Coastal Plain. As sea level fell during each regression it left behind a coastal dune field, the oldest of which have consolidated to form North-South aligned ridges of aeolianite limestones (URS 2001a). Ridges that occur above present-day sea level usually bear a mantle of Holocene dunes. Those below sea level form sublittoral reefs, often undercut and cavernous on the seaward side. Small islands, representing high points of flooded ridges, are a relatively common feature within a few kilometres of the shore.

Semi-sheltered lagoonal habitats are developed behind offshore limestone reefs in many localities. The degree of shelter is variable, depending on the depth and continuity of the offshore reefs and islands. The shore is commonly comprised of long sandy beaches with occasional rocky cliffs and headlands where the limestone outcrops. Notched intertidal rock platforms are a feature of this coast.

The sediments of the littoral and shallow water zone of Champion Bay are primarily seagrass derived (i.e. mainly composed of microscopic shells of seagrass-associated organisms), with secondary riverine quartz sediment input and dune related carbonate sediment input (Tecchiato *et al* 2012). There is an overall south to north transport pattern driven by south-westerly swell waves and strong sea breeze wave fields, however, temporary reversal can occur during powerful north-west swells potentially associated with tropical storms or large winter storms (Tecchiato *et al* 2012, Stull *et al* 2014).

Champion Bay is one of many partially protected embayments that occur along the coast within the Central West Coast Region. While the Bay has extensive reef along its western side, this generally rises to only 8 to 10 m below sea level and there are no offshore islands to provide protection from wave energy. Swell height at the coast is attenuated by coastal limestone ridges; however wave heights and periods are sufficient to initiate bottom sediment particle movement over the entire Geraldton inshore platform (Tecchiato *et al* 2012). The limited protection of Champion Bay is evidenced by the relatively narrow, high energy beaches found along most of its length and the relatively small amount of sediment which is present on the floor of the Bay. Only the south-eastern corner of the Bay has a level of protection sufficient to allow the development of extensive seagrass beds on thick sand veneers overlying the limestone pavement.

# Appendix A.2. Benthic Communities and Habitats

## A.2.1 Characteristics, Distribution and Condition of Benthic Habitat and Communities

### Broad Scale Habitat Mapping – Champion Bay

Habitat mapping undertaken by AECOM (2020) identified that the benthic habitats of Champion Bay and the surrounding area can be broken down into a range of habitats, with the key feature of the Bay the limestone substrate which underlies most of the bay and surrounds. Limestone reef presence, relief or reef profile, and the depth of sand overlaying reef, are key factors which influence the epibenthic communities in the bay and surrounding areas. Exposure from prevailing south westerly swell and seas is also a key factor as they play a pivotal role in the movement and dispersal of sand within the bay. Deposition, erosion or frequent resuspension of sand due to wave and tidal water movement greatly influences what type of epibenthic communities colonise certain areas in the bay. Key distinctions can be seen in habitats with similar depths, topography and substrate slope but with varying levels of protection from swell and waves. AECOM described the following natural habitat types, and associated communities:

1. Deep water sand, No epibenthic macrobiota;
2. Deep water pavement with sand, Macroalgae dominant;
3. Deep water reef slope, Macroalgae;
4. High profile deep reef 1-4 m, Macroalgae dominant;
5. Sloping pavement with sand, Low density macroalgae and seagrass;
6. Pavement with sand, No macrobiota;
7. Pavement with sand, Low density seagrass;
8. Pavement with sand, High density seagrass;
9. Pavement with shallow sand, Seagrass dominant;
10. Pavement with sand, Macroalgae
11. Low profile reef with sand, Macroalgae and seagrass codominant;
12. Low profile reef with deep sand, Low density seagrass and macroalgae;
13. Low profile reef with sand, seagrass and macroalgae; and
14. High profile shallow reef 1-4 m, Macroalgae dominant.

A summary of the habitat mapping is described below. Please refer to AECOM (20210) for further details.

#### Deep Water Communities and Habitat (1-4)

The deep-water habitats typically occur west of a series of north south orientated limestone reef systems which run from Point Moore to the north of Champion Bay and continue on past Drummonds Point. These habitats occur where the low-profile reef with sand become the high-profile reef line which forms the western edge of Champion Bay and the deep-water offshore habitats of Geelvink Channel. The habitat is highly variable as it transitions from high profile macroalgae dominated reef in relatively shallow waters (8–12 m) to the deeper (>20 m) sand and sand covered pavement offshore habitats. The area is characterised by very high profile (> 4 m) reef walls and overhangs which give way to sloping pavement into deeper water. Epibenthic biota were also highly variable.

Benthic communities associated with low and high relief reef are macroalgal with common species such as red and brown algae (*Sargassum* and *Ecklonia*) with a conspicuous understory of *Amphibolis* and *Thalassodendron* seagrass. Interspersed amongst these floral assemblages are substantial patches of completely bare, heavily rippled deep sand. The deep-water reef slope benthic communities are highly variable with small red and brown algae, brown lobed algae, crustose coralline algae, and sporadic sponges and solitary hard corals including *Turbinaria*, *Faviids* and small *Acropora* species. Deep water pavement and sand habitats typically comprised no benthic communities or were dominated by *Sargassum* and *Ecklonia* some patches of low cover *Amphibolis* and *Thalassodendron*.

### Limestone Pavement and Sand Communities and Habitats (5-10)

Limestone pavement, with overlying sand of varying depth which receives regular resuspension from swell waves and currents, comprise most of the habitat type in the eastern side of Champion Bay. It's characterised by gradually sloping sand veneered pavement and supports a mosaic of mixed assemblages of macroalgae and seagrass interspersed with equal areas of bare sand. The south-eastern corner of Champion Bay and directly north of the fishing boat harbour entrance is characterised by areas of stable sand generally overlaying pavement. The area receives some protection from swell waves and consequently supports large high-density seagrass meadows, typically dominated by *Halophila, Syringodium* and *Posidonia* with up to 90% coverage mapped.

The seabed in the central part of Champion Bay is the deepest continuous area in the bay forming a natural basin between the eastern nearshore area and the high-profile western reefs. The topography is relatively flat with no sloping in either direction. The area is predominantly sand covered substrate with seagrass meadows of mostly moderate to dense (up to 70% cover) *Amphibolis* with *Halophila* and *Syringodium*. Low densities of small red and brown algae, *Ecklonia* and *Sargassum* also occur.

Several areas in shallow water fringing the fishing boat harbour, and north of the Northern Reclamation DMPA, consisted of deeper sand on pavement which supported little to no benthic communities. The area is often characterised by loose seagrass and macroalgal wrack. Two areas further seaward also featured sand across large areas with very little benthic communities.

Low density seagrass meadows on sand veneered pavement account for a large area directly north of the fishing boat harbour up to the start of the entrance channel. The 10 m isobath appeared to be the depth limit for seagrass dominance in this habitat. West of the fishing boat harbour a band of low-density meadows stretching from the 4 m isobath seaward to the start of the low profile reef areas gradually curving south towards Point Moore. Substrate in the area was characterised by moderately deeper sand veneers on pavement with seagrass density ranging from 5% to 50% and dominated by *Halophila*. Smaller patches of low cover *Posidonia* and *Syringodium* were also observed.

### Shallow Reef Communities and Habitats (11-14)

Running along the south-eastern shoreline of the Bay from Sunset Beach southwards to just north of the marina, and extending out ~400 m from shore, is an area of dissected limestone shoreline platform with high relief at the offshore end. The habitat contains numerous holes and depressions and supports predominantly large *Ecklonia* and *Sargassum*, with occasional patches of high density *Amphibolis* and *Thalassodendron* seagrass.

North of the entrance channel, low profile reef with sand encompasses the transition between the central basin and the high-profile western reefs. Topographically, the area is predominantly moderate profile (0-1 m) with a

gradual rise of approximately 2-4 m from the border of the central basin to the base of the high-profile western reefs. Macroalgae dominate the higher relief areas, while seagrass dominate the lower relief areas which also feature sand. Both biota groups were recorded at up to 50% cover with *Amphibolis* dominating the seagrass taxa and *Sargassum* with *Ecklonia* dominating the macroalgae.

The south-eastern corner of the Bay is characterised by a shallow nearshore area of low-profile reef consisting of rocks, cobbles and low-profile limestone outcrops, surrounded by areas of mostly bare sand. As the seabed becomes shallower towards the shoreline, progressively less limestone is exposed, and deep sand becomes more prominent. Reef areas support low density small algae, with areas of sand supporting low density *Posidonia* and *Halophila* seagrasses. The area also comprised areas of dense seagrass wrack on bare sand.

South of the entrance channel areas of undulating substrate comprising a mix of low-profile limestone rises interpreted with sandy patches and higher relief reef occur. Low-profile limestone predominantly comprises macroalgae, whilst sand inundated pockets support seagrass such as *Halophila* and *Posidonia*. Sections of higher relief support dense communities of small red and brown algae, *Ecklonia* and *Sargassum.* Notably, *Posidonia* is distinct to the southern areas as the northern low profile reef areas are dominated by *Amphibolis*.

### A.2.2 Champion Bay Habitat Map

Based on data from AECOM (2020) and BMT (2021a), O2 Marine created a consolidated habit map for the LAU. The consolidated habitat map is presented in Figure 9.

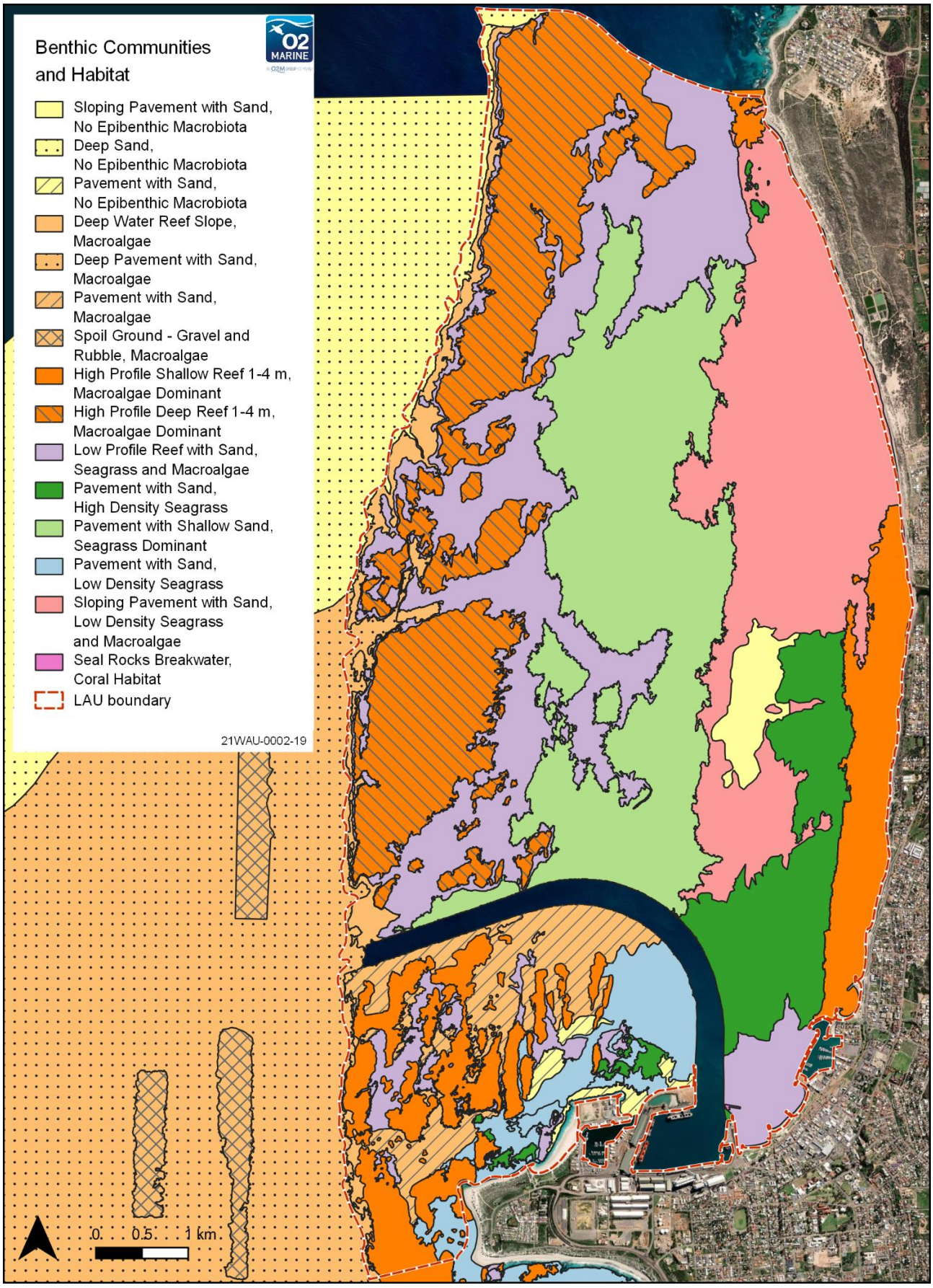



Figure 9 Champion Bay Habitat Map – source data AECOM (2020) and BMT (2021a)

### A.2.3 Seagrass Condition

To determine the current baseline, or pre-dredging, seagrass health and condition, BMT (2021b) undertook a health investigation at key locations previously incorporated into Geraldton Port dredging programs (2002/2003 and 2012). BMT (2021b) collected data on six key seagrass health indicators across 14 sites within Champion Bay, along with sites at Greenough, Dongara and Jurien Bay to provide regional context. As many of these sites have historical data a comparison with previous data to provide statistical assessment on the current health was completed.

Overall BMT (2021b) summarised that seagrass indicators, such as shoot density, shoot height, leaves per shoot/cluster and aboveground biomass measured at *A. antarctica* and *P. sinuosa* sites showed a relative increase compared to the historical dataset. BMT (2021b) also identified fluctuations within community composition and health over the years. It was identified that this had also occurred within the wider monitoring program and also worldwide. BMT (2021b) surmised that the dynamic nature of Champion Bay (strong waves and currents) are continuously responsible for redistributing sand within the Bay, which is responsible for both creating new, and destroying old BCH communities. It is also possible that global water temperature rise, and the marine heatwave from 2011 may have been responsible for community shifts observed during 2021. It is therefore reasonable to assume that a high level of natural variability occurs within Champion Bay BCH habitats, particularly for seagrasses.

## Appendix A.3. Marine Environmental Quality

### A.3.1 Water Quality

Water clarity in Champion Bay is variable during the year as a result of wind driven current strengths and wave energy, as well as intermittent rainfall runoff in the catchments of the rivers, such as the Greenough and Chapman Rivers that drain the hinterland. Typically, the season of lowest water clarity is winter as a higher energy swells mobilising bottom sediments and due to this being the main time during which the intermittent discharge to the Bay of alluvial sediments from river discharge. In wet years, the Bay remains turbid for many months and salinity of nearshore waters slightly decreases as a result of river inflow. Strong winds in summer create waves that also cause an increase in suspended particulate matter which can also reduce water clarity. The period of greatest water clarity is usually in late summer to autumn (February to May) and occurs in response to reduced wind strengths and wave energy and absence of riverine sediment input.

Turbidity within Champion Bay typically increases closer to shore, mostly as a consequence of wave action that lifts sands and silt-sized particles into the water column (URS 2001). During spring and summer there is often a marked diurnal effect, with the increased wave action generated by the strong mid-morning to evening sea breezes increasing coastal turbidity compared to the early morning and dawn calms. During autumn and winter, turbidity and cloudiness (discolouration) is also often elevated in the inner half of Champion Bay, a period when fine organic material from the nearshore and shoreline wracks of decaying seaweed and seagrass is suspended and dispersed through the nearshore water column. Apart from the natural sources and cycles of turbidity, propeller wash from ship and tug movements along the inner sector of the entrance channel also contributes to turbidity. Marked variations in turbidity therefore occur within hourly, daily, weather-system and seasonal time cycles, as well as with depth.

Limited data is available for the wider Champion Bay marine environment, though there are limited activities which are likely to result in any marine environmental impacts. Identified activities and their potential, temporary impacts may include:

- Aquaculture fish farming within Champion Bay may have a localised impact over short duration on water quality, such as minor nutrient loading[4].
- Shipping and tug movement within the entrance channel result in localised, short duration turbidity plumes on a regular basis.
- Commercial and recreation vessel activities may have minor, highly localised impacts on water quality from hydrocarbon spillages, rubbish or vessel anode deterioration.

During periods of warmer water, when swell and wind conditions result in very calm sea surface condition, temporary blooms of *Trichodesmium*, a filamentous cyanobacteria, may occur within Champion Bay. These blooms typically dissipate quickly when wind or sea state become more unsettled and are considered natural events, however they may have short duration impacts upon water quality during periods of extended blooms.

However, previous seabed levelling activities occurring at the FBH entrance and dredging activities of sediments from the Shipping Channel provide some indication of the light climate and toxicant concentrations for ambient conditions within Champion Bay. These are summarised below.

### Light Climate

Two seabed levelling campaigns have been conducted; one during June 2020 (O2 Marine 2020) and the second during October/November 2021 (O2 Marine 2021c). Seabed levelling activities employed a custom designed underwater 'plough' which effectively drags accumulated sediments from the target area and re-deposits the sediment back into the natural longshore drift area where they re-enter the natural system. This involved removal of sediments accumulated in the entrance channel and Lives Beach with sediments being relocated approximately 250-300 m north/northeast. During these campaigns daily light integral (measured as hourly Photosynthetically Active Radiation) was measured at two sites including a nearby impact location at the nearest BCH receptor and another reference site located north of Point Moore. Both sampling campaigns identified no significant alteration to the light climate during dredging when statistically compared to pre and/or post seabed levelling periods. Doing the 2020 program DLI was calculated over a 48-day period with a maximum of 5.41 mol/m$^2$, a minimum of 0.50 mol/m$^2$ and an average of 3.41 mol/m$^2$ from the impact location adjacent to the FBH. During the 2022 program DLI was calculated over a 78-day period with a maximum of 5.72 mol/m$^2$, a minimum of 0.54 mol/m$^2$ and an average of 3.40 mol/m$^2$ at the impact site. The reference site reported a DLI maximum of 21.33 mol/m$^2$, a minimum of 1.79 mol/m$^2$ and an average of 13.61 mol/m$^2$.

### Toxicant Concentrations

Previous dredging campaigns targeting accumulated sediments within the navigation channel have occurred during 2012 and 2022. Whilst these programs also targeted inner harbour sediments, only the water quality data collected at ambient reference sites is considered applicable for assessment of ambient conditions relevant to Champion Bay and therefore this Project. These are described further below.

[4] It is noted that currently no aquaculture activities are presently occurring within designated Champion Bay Indian Ocean Fresh Aquaculture Leases

### 2012 Maintenance Dredging

A water quality monitoring program was implemented by MWPA[5] (GPA 2013) as part of the environmental management program developed for the 2012 maintenance dredging program. The program was typically identified to determine the water quality within the moderate ecological protection area (MEPA) (i.e. the inner harbour) and the high ecological protection area (HEPA) (i.e. Champion Bay). Only data from the HEPA is assessed herein.

The sampling program incorporated collection and laboratory analysis of dissolved metals, tributyltin (TBT) and polycyclic aromatic hydrocarbons (PAH). Sampling events included one round pre-dredging, two rounds during dredging and seven events post dredging.

A summary of the key sampling results is provided below.

- Pre-dredging:
  - Copper exceeded the 99% Species Protection Level (SPL) at six of seven sites in the HEPA;
  - PAH and TBT concentrations were all below the limits of reporting (LoRs).
- During Dredging:
  - Copper and zinc exceeded the 99% SPL within the HEPA at several sites on both sampling rounds;
  - Silver (two sites) and nickel (one site) exceeded the 99% SPL on the second sample round only:
  - PAH and TBT concentrations were all below the LoRs.
- Post Dredging
  - TBT and PAH were not samples based upon no detection during or pre dredging;
  - Zinc and copper exceeded the 99% SPL at some sites during the first two rounds;
  - Silver exceeded the 99% SPL at one site during round two;
  - No exceedances occurred within the HEPA sites during rounds three to seven.

### 2022 Maintenance Dredging

A water quality monitoring program was implemented by O2 marine (O2 Marine 2022d) as part of the dredge environmental management plan (O2 Marine 2022) developed for the 2021 maintenance dredging program. The program was typically identified to determine the water quality within the low ecological protection area (LEPA) (north-western corner of inner harbour), MEPA (i.e. the inner harbour) and the HEPA (i.e. Champion Bay) as presented within Figure 5. Only data from the HEPA is assessed herein.

The sampling program incorporated collection and laboratory analysis of dissolved metals, TBTs, hydrocarbons nutrients and total suspended solids (TSS). Sampling events included two rounds pre-dredging, five rounds during dredging and two events post dredging.

A summary of the key sampling results is provided below.

- Pre-dredging:
  - Copper exceeded the 99% SPL at the MEPA/HEPA boundary on both sample events;
  - Zinc exceeded the 99% SPL at all three sites on both sample events;
  - Hydrocarbons and TBT concentrations were all below the LoRs

[5] Then the Geraldton Port Authority

- Nutrients levels were typically low at all three sites;
- TSS results were all reported below the LoR of 5 mg/L.

- During Dredging:
  - Copper exceeded the 99% SPL at all three sites on one sample event and at one site during two sample events;
  - Zinc exceeded the 99% SPL at all three sites during two sample events;
  - Hydrocarbons and TBT concentrations were all below the LoRs;
  - Nutrients levels were typically low at all three sites;
  - TSS ranged from below1 mg/L up to 4 mg/L.
- Post Dredging
  - Copper exceeded the 99% SPL at two sites during the first sample event and at all three sites during the second sample event;
  - Zinc exceeded the 99% SPL at two site on the first sample events and at no sites during the second sample event;
  - Hydrocarbons and TBT concentrations were all below the LoRs;
  - Nutrients levels were typically low at all three sites;

### A.3.2 Sediment Quality

A desktop preliminary site investigation was conducted in accordance with National Assessment Guidelines for Dredging (NAGD) (NAGD 2009) and the National Environmental Pollution (Assessment of Site Contamination) Measure (NEPM) (NEPC 2013), of historical sediment sampling programs undertaken within the FBH and adjacent areas together with a consideration of potential pollutant sources (O2 Marine 2022e). The desktop assessment identified a minimum of 12 sample locations required to satisfy the NGD sample number requirement, with 50% requiring analytical assessment due to the sediments being catagorised as 'Probably Clean'. Based on the assessment of potential contaminants the target list of Contaminants of Potential Concern (CoPC) was identified as:

- Metals (Cu, Pb, Zn, Cr, Cd, Ni, Hg, As);
- TBTs;
- Hydrocarbons (TRH, PAH and BTEXN); and
- Nutrients (TN, TKN, NH4, NO2+NO3, TP and FRP).

The assessment identified three historical investigations conducted within the past five years which involved collection of suitable sediment samples within the proposed dredge footprint. Across these three investigations a total of seven sediment sampling locations, equating to 16 primary samples collected and analysed within the proposed dredge footprint. All sediment samples were analysed by National Association of Testing Authorities (NATA) accredited laboratories and field and analytical QA/QC protocols determined to be implemented in accordance with NAGD (2009).

Sediments were typically characterised as medium to fine grained, grey sediments of natural origins such as a combination of coastal silicate sands transported along the coast via localised northern longshore drift, or marine carbonate sediments transported from offshore sources via oceanic swell and the longshore current. Sediments were considered clean and contaminant free with no exceedances of applicable guideline values for sediment

assessment (ANZG 2018). Physical properties and contaminants assessed across the site were low in vertical and horizontal spatial variability, indicating that accreted material has originated from the same natural source, whilst being continuously redistributed within the defined study area. Sediments were identified to contain nutrients from natural sources, such as seawrack, based on the presence of organic nitrogen and phosphorous. Inorganic nutrient forms were very low, barley being detected above laboratory levels except ammonia. The presence of ammonia indicates that a small proportion of organic nitrogen was being converted under anoxic conditions.

## Appendix A.4. Air Quality

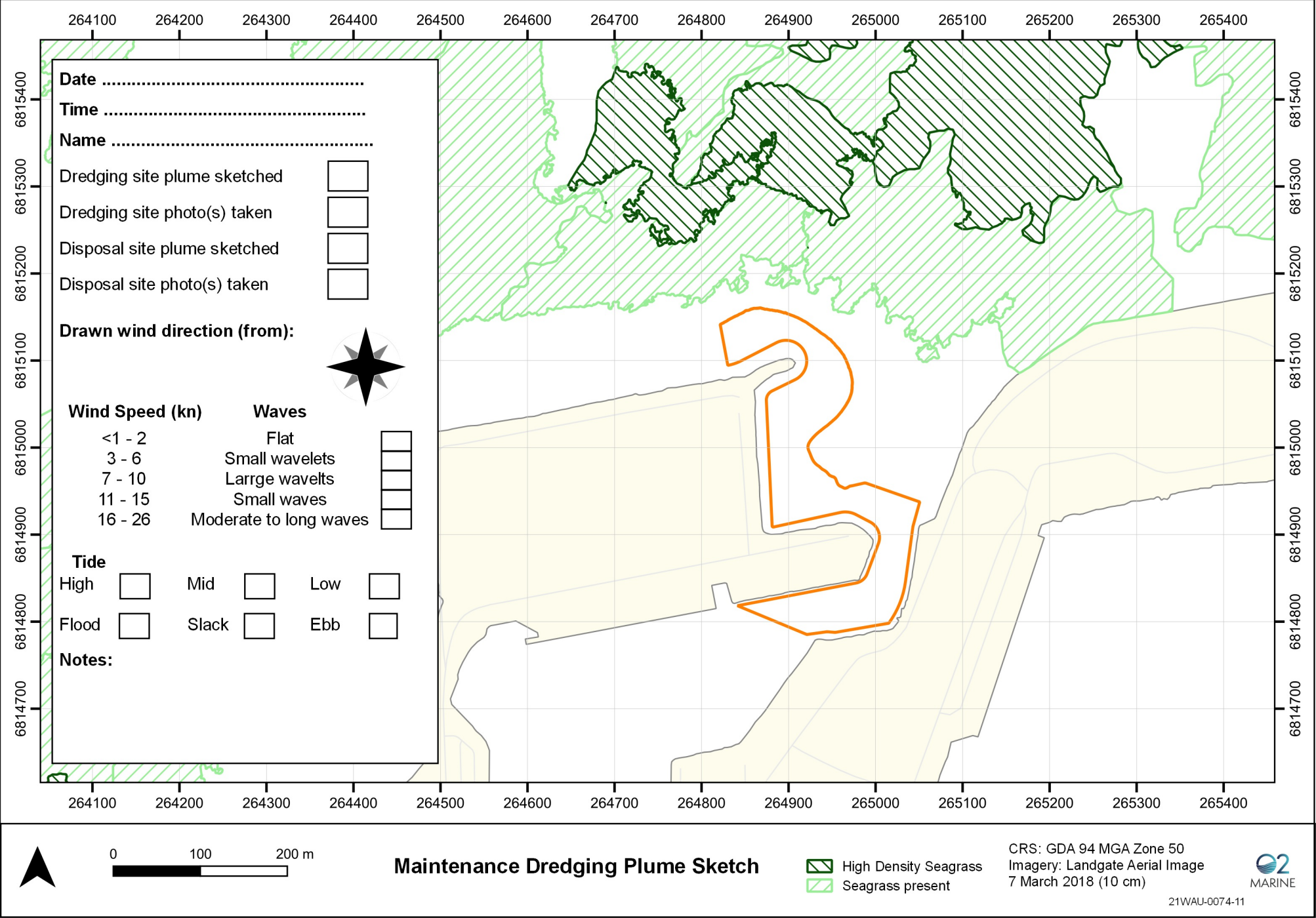
Geraldton Port and the FBH are located within a coastal environment characterised by strong seasonal winds, sparse vegetation cover and industrial lands which are mostly sealed. Air emissions sources within this setting can be described as natural or operational as per the below examples. Operational sources also include port controlled and non-port controlled sources, including but not limited to:

- Natural dust source examples:
  - Windblow sea spray and salts;
  - Windblown beach sands; and
  - Natural dust storms or pollen.
- Operation dust source examples:
  - Fugitive dust from product handling;
  - Fugitive dust from truck and train unloading;
  - Windblown dust from unsealed lands (port and non-port controlled);
  - Vehicle and vessel exhaust emissions (port and non-port controlled);
  - Windblown dust from regional agricultural activities; and
  - Bushfires, and prescribed burning.

Air quality monitoring is undertaken by DWER at a number of regional and metropolitan locations within WA in accordance with the National Environment Protection (Ambient Air Quality) Measure (NEPM) DWER 2021b). Monitoring of PM10 and PM2.5 in Geraldton has been undertaken by DWER since in 2005 and 2019, respectively. The Geraldton site was established in the mid-west of the state to monitor windblown crustal material and smoke from bushfires, prescribed burns, agricultural stubble burning and wood-fired home heaters.

24 hour averaged $PM_{10}$ results reported for the Geraldton region for 2020 indicate a maximum of 445.6 µg/m$^3$ and an annual average of 20.9 µg/m$^3$ whilst for $PM_{2.5}$ a 24 hour averaged maximum of 162.3 µg/m$^3$ and annual average of 8.0 µg/m$^3$ was reported (DWER 2021a). The NEPM for $PM_{10}$ is 50 µg/m$^3$ for an 24 hour averaged period and 20 µg/m$^3$ annualised average, whilst for $PM_{2.5}$ the NEPM is 25 µg/m$^3$ for an 24 hour averaged period and 8.0 µg/m$^3$ annualised average. Exceedances of the NEPM daily standards from PM2.5 and PM10 are believed to be a result of bushfires, hazard reduction burns and natural events such as windblown regional dust. DWER monitoring shows that elevated particle levels in Geraldton occur predominantly in the afternoons and generally during the drier summer months.

# Appendix B. Daily Dredge Plume Sketch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Date .....
Time .....
Name .....
Dredging site plume sketched
Dredging site photo(s) taken
Disposal site plume sketched
Disposal site photo(s) taken
Drawn wind direction (from):
Wind Speed (kn)
Waves
<1 - 2
Flat
3 - 6
Small wavelets
7 - 10
Larrge wavelts
11 - 15
Small waves
16 - 26
Moderate to long waves
Tide
High
Mid
Low
Flood
Slack
Ebb
Notes:
0
100
200 m
Maintenance Dredging Plume Sketch
High Density Seagrass
Seagrass present
CRS: GDA 94 MGA Zone 50
Imagery: Landgate Aerial Image
7 March 2018 (10 cm)
MARINE
21WAU-0074-11